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# Diagnostic Roentgenology in an Army General Hospital During the Present War[1]

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A KNOWLEDGE OF the past in medicine is always profitable to the student, demonstrating that keen observation and hard work can overcome many obstacles; recalling that major accomplishments have often been obtained with but meager and inadequate tools. Looking backward, we both admire and derive inspiration from the life and work of such a pioneer in his chosen field as Preston Manasseh Hickey. Recalling to mind a few facts concerning the life and work of this eminent physician will picture to us a man who was one of the leaders and pioneers in radiology. Some men are great because of outstanding individual accomplishments, but to our mind the greatest man is the teacher who not only does outstanding work himself but transmits his knowledge to others and is an inspiration and guide to younger men who are fortunate enough to be associated with him.

Preston M. Hickey was born in Ypsilanti, Michigan, in 1865. He attended the Detroit Public Schools and the University of Michigan, where he received his Bachelor of Arts Degree in 1888. This classical training provided him with a basis for a broad cultural background, rounding out a personality which might otherwise have become too exclusively devoted to "dry and scientific" matters. It is said that he was once reproached by a casual shipboard acquaintance for just such a narrow attitude and that he silenced his critic by the eloquent recitation of Shelley's "To a Skylark."

In 1892 he obtained the degree of Doctor of Medicine from the Detroit College of Medicine and Surgery. Thereafter his interests were varied, including photography, microphotography, and pathology. Early in his medical practice he specialized in diseases of the upper respiratory tract and chest. These pursuits, together with his desire to obtain perfection in the removal of foreign bodies from the eye and the bronchial tree, paved the way for his ultimate specialization in roentgenology. As a result, he acquired one of the first roentgen-ray machines in the State of Michigan. It is not surprising, in view of his interest in photography, that he placed great emphasis on the proper technic in making x-ray plates and was among the first to develop an illuminated lightbox for plate reading.

Doctor Hickey was constantly concerned with the welfare of his patients and considered their interests best served when a short history was taken at the time of radiographic examination, in order that the films might be interpreted in the light of the clinical findings. He had little patience

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with the self-styled radiologist who habitually employed abstract film study in diagnosis. He constantly impressed upon the referring members of the staff the necessity of including important data in their requisitions for roentgen studies. We are convinced of the fundamental importance of this attitude.

Doctor Hickey insisted that members of his staff perfect themselves in radiographic technic and that they become competent to perform any examination as well as or better than members of the technical staff. This included film processing as well as exposure technic. We are likewise impressed with the importance of acquiring such technical skill, for the radiologist in the Army may find himself with an untrained staff and, unless he is thoroughly familiar with the technical aspects of his work, the preparation of a satisfactory exposure technic and the direction of the many other technical procedures in an x-ray department may be accomplished only with great difficulty. The specialist in radiology can attain the highest efficiency only if he is himself an accomplished technician as well as a diagnostician.

In 1917 Doctor Hickey was among the first to volunteer for military service. He went abroad with the Harper Unit, but shortly thereafter was assigned to duty as roentgenologic consultant for the American Expeditionary Forces. Here, in both an advisory and administrative capacity, he was most successful. He was effective in liaison work and possessed to an unusual degree the ability to obtain close co-operation from his fellow officers and those members of the British and French Medical Corps with whom he was associated.

As stated previously, one of Doctor Hickey's outstanding characteristics was his talent for teaching, and he was at his best in clinical conferences and in kindly, stimulating talks with students. Having a wide knowledge of the entire field of radiology, he had the rare faculty of transmitting this knowledge to those who sought instruction. His ability was early recognized, for he became the Professor of Roentgenology of the Detroit College of Medicine and Surgery in 1909, which position he held until 1922. After the World War he re-entered private practice, but in 1922 was appointed Professor of Roentgenology in the University of Michigan School of Medicine. Here he was afforded an unusual opportunity in instruction and organization, and he more than lived up to all that was expected of him. He planned, organized, and watched grow to maturity one of the outstanding departments of radiology in this country.

Doctor Hickey was tolerant of all men and envied none. Much has been written extolling his virtues, his capacity for industry, and his extraordinary ability for organization. We have tangible evidence of his ability along these lines in his many writings and in the excellent Department of Radiology that he organized and directed. Perhaps one of his most important contributions to medical education in general, and radiology in particular, was his work with the *American Journal of Roentgenology*, which he founded, and which he edited for many years.

We, as representatives of the Armed Services, wish particularly to pay tribute to Doctor Hickey, who, with entire disregard for self-interest, comfort, and financial sacrifice, enlisted early in the "Great War," although already at an age well beyond that of most men entering the services. He served with distinction and, with a few others, did much to establish the present high standards of radiology in the United States Army. Radiology in America, and in the world as well, is fortunate in having as one of its pioneers such an outstanding physician.

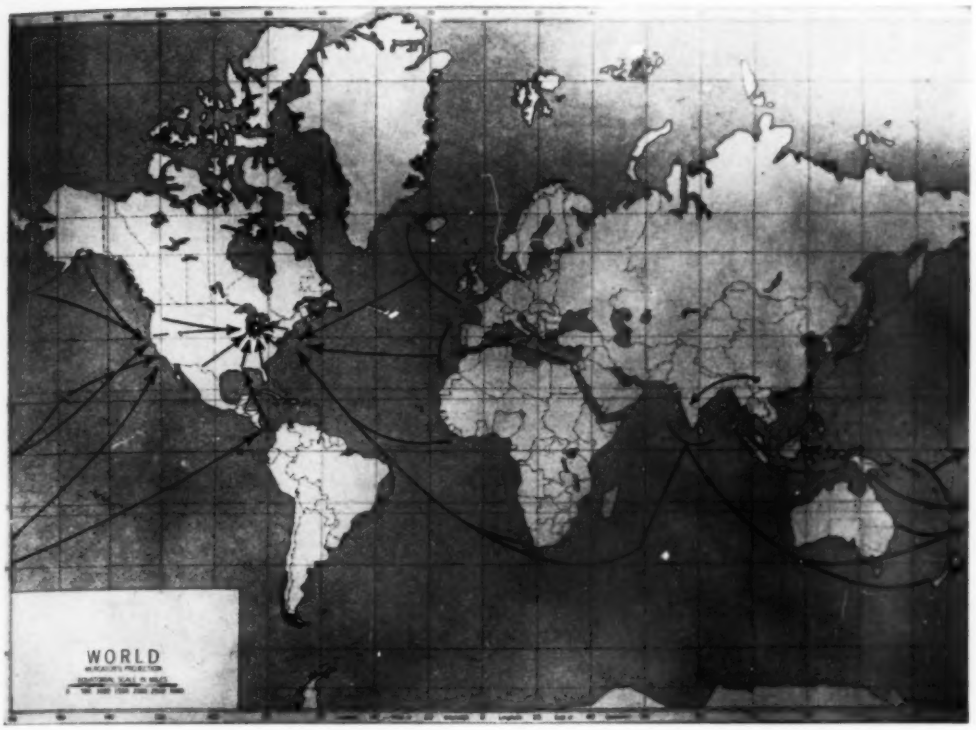


Fig. 1. Map showing in a general way the areas throughout the world from which patients have been received.

### THE FUNCTION OF THE MEDICAL DEPARTMENT OF THE ARMY

The function of the Medical Department of the Army is to preserve the health of the personnel, to treat those who are ill, to rectify as far as possible damage from accidents, injuries of all kinds, including those incurred in the face of the enemy, and to return as many men as possible to active service. When return to active duty is not possible, it is then the function of the Medical Department to place each man in the best possible physical condition before he is released from the Army or, in some instances, turned over to the Veterans' Facility for further medical care.

In battle the Medical Department begins to function very close to the front line, where injuries are treated and the soldier is returned to duty when possible. More serious injuries may require evacuation to more adequate medical installations, where further treatment can be administered. Again, as many as possible are returned to active duty, while those with still more serious injuries or diseases are again evacuated to medical installations farther from the fighting front, where definitive treatment may be instituted. Those who can return to active duty within a reasonable period of time do so. Where this is not possible, the patients are further evacuated, and some of those suffering from the more complicated diseases and injuries, those requiring special treatment or treatment over long periods of time, eventually arrive at one of the named general hospitals within the continental limits of the United States.

### THE NAMED GENERAL HOSPITALS

The named general hospitals are fixed installations completely equipped and adequately staffed by specialists. In them

is provided medical care of the highest type available in the Army, comparing favorably with any private institution in America. General hospital patients who can return to duty after suitable treatment do so, regardless of the length of time required to restore them to health. Others, who cannot be returned to duty, can be discharged only after they have reached the maximum improvement possible in a hospital of this type. Certain chronic diseases and disabilities resulting from injuries are such that they reach a level beyond which improvement will not take place in a general hospital. Such patients are discharged to the Veterans' Facility for further care or, in some instances, are retired on pension.

The services in the general hospitals are highly specialized, and certain institutions are, in addition, equipped and staffed in order that treatment not available in the average general hospital may be provided. These specially equipped hospitals are designated as centers for the study and treatment of specific conditions. The Percy Jones General Hospital has been designated as an amputation center, a neurosurgical center, a center for chest surgery, for roentgen therapy, and for the study of malaria. The importance and value of centers of the above type are evident in the results obtained.

The patients entering our institution at the present time come from almost all parts of the world. Some are transferred from Station Hospitals and other hospitals near our institution. Others are transferred from various installations throughout the United States, either because of our special facilities for treatment or in order that the patients may be hospitalized as near home as possible, the latter being an established Army policy. Many are battle casualties coming from long distances. The various parts of the world from which we receive patients are in a general way indicated by Figure 1. Because of the many regions from which these patients come, disease conditions are being seen which are not ordinarily encountered in the civilian hospitals of the United States.

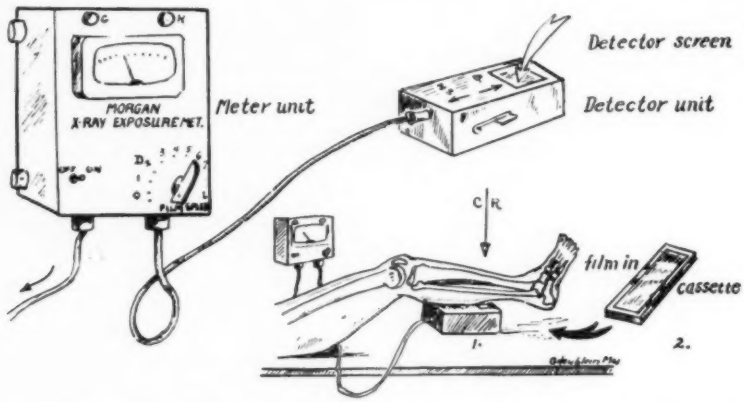


Fig. 2. Morgan meter: meter and detector units and method of use. Drawings by Major Heublein.

## X-RAY DEPARTMENT OF THE PERCY JONES GENERAL HOSPITAL

It was the good fortune of one of us (J. C. B.) to be given the responsibility of planning and equipping the X-Ray Department of the Percy Jones General Hospital. The Commanding Officer, then Colonel Norman T. Kirk, now the Surgeon General of the Army, exhibited a full understanding of the requirements, responsibilities, and value of the x-ray service. He insisted that the space allotted be adequate, that the equipment be of the best

and sufficient to meet all of the needs of a hospital of this type. We have, as a result, a department that is centrally located, completely equipped, and well planned, with approximately 6,000 square feet of floor space.

In addition to the usual equipment of a hospital of this type, we have quick-changeover switches and spot-film tunnels, for compression exposures in gastro-intestinal examinations, with two of the four 200-ma., 100-kv. combination radiographic and fluoroscopic machines. There are equipment for myelography, an attachment for the field unit for encephalography, modifications in the Bucky diaphragms permitting serial radiography in examinations of the gastro-intestinal tract, and an experimental model of the Morgan meter for predetermination of the proper x-ray exposure.

We have a completely equipped roentgen therapy division with a 220-kv. oil-cooled machine together with a superficial water-cooled unit with a capacity up to 135 kv. The cystoscopic division is separate from the main department, being located near the operating pavilion on the sixth floor of the hospital. A conveniently located darkroom provides facilities for processing of films made during cystoscopy or in the operating rooms. There are two cystoscopic tables with separate tubes but with a single transformer and control, there being a high-tension switch which permits the use of either table.

### THE MORGAN METER

We have been fortunate in having an opportunity to study the Morgan exposure meter in this hospital. This meter takes advantage of the fact that all properly exposed x-ray films are of an average density of 0.9 in the diagnostic range as read on a densitometer. This is true whether the examination be of the spine, skull, chest, extremity, or of any other part of the body.

This meter, shown in Figure 2, consists of two parts, a detector unit and a meter unit. The detector is used prior to exposure of the film, being placed under the part which is to be examined and exposed, using any suitable kilovoltage. The proper exposure time is indicated on the dial of the meter unit. After the initial exposure, the detector unit is replaced by a film, which is exposed in the same manner and with the factors already used, but with the previously determined exposure time.

Fig. 3. Exposure made with lower leg in cast. Morgan meter employed to determine exposure time.

Many simple and complicated examinations have been made using this device, and good results have been obtained. All instances of failure have been due to improper positioning of the detector unit. Excellent results have been obtained with amputation stumps, in cases where there has been considerable demineralization and in those cases where the proper exposure could not be determined by measurement because of bone condensation changes or calcification in the soft tissues. We have found the meter especially valuable in obtaining films of brilliance and clarity in orthopedic cases where extremity films must be made through plaster, as is shown in Figure 3. It has been observed that in

follow-up examinations much more uniform exposures are obtained when the meter is used than when reliance is placed on measurement technics, often employed by different members of our technical staff.

CASE 1: A 23-year-old white private, first class, began to suffer from pain in his left leg two years prior to his entrance into this hospital. Six months before admission a tumor was found in the femur at Letterman General Hospital. This is shown in Figure 4. The biopsy diagnosis was atypical tel-

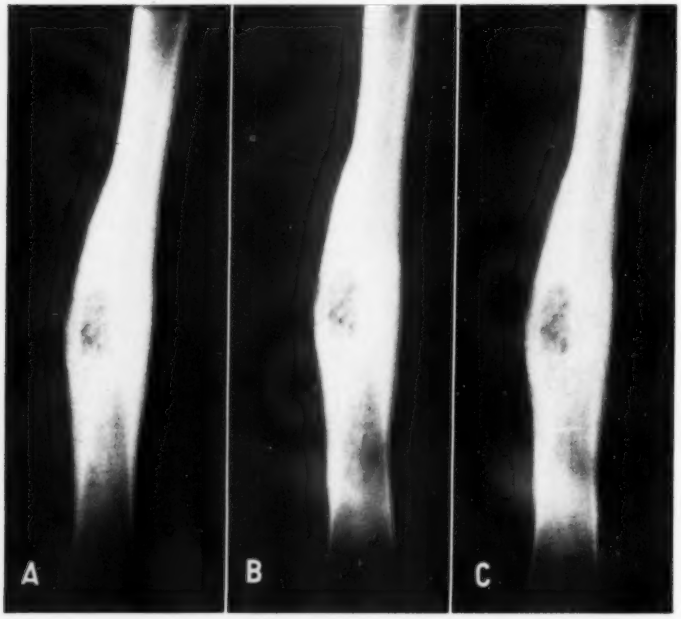


Fig. 4. Case 1: Exposure times determined with the Morgan meter. A. 50 kv., 240 ma. B. 70 kv., 45 ma. C. 80 kv., 24 ma. There is no significant difference in detail in the three films.

We have not only proved to our own satisfaction that film density remains constant over a wide range of kilovoltages, as is shown in Figure 4, but we have also been able to disprove to our own satisfaction the theory that high filtration improves contrast by making the incident ray more homogeneous. The latter is shown in Figure 5. Suffice it to say that we are convinced the Morgan meter is a great asset in the field of modern radiography and that the radiologist can look forward with confidence to its future usefulness in the diagnostic field, especially for solving new and difficult problems, and for improving and stabilizing standard technics.

The history in the case shown in Figure 4 is of interest.

angiectatic sarcoma. Operation showed the medullary canal to be filled with firm tumor tissue. The tumor was found to extend into the soft tissues and roentgen therapy was given to eight fields, the total dosage to each field being 1,200 r. The leg became asymptomatic. The slides were reviewed by the Army Medical Museum, where a diagnosis of ossifying angioma of bone was made. Another pathologist made a diagnosis of osteoid osteoma. The pain recurred and the patient was transferred to this hospital, where re-examination showed bone changes that were considered characteristic of those resulting from a malignant tumor. Subjective improvement followed irradiation through two fields, the total dosage being 1,800 r to each field. Amputation was done Feb. 24, 1944. The specimen showed an infiltrating malignant tumor which was considered by our pathologist to be characteristic of metastatic adenocarcinoma, the primary site of which could not be determined. A careful review of the case has failed, however, to show evidence of any tumor aside from the one in the femur.

### WEEKLY CONFERENCES

Weekly conferences are held by the medical and surgical services, in which our staff takes part, presenting the x-ray findings in the cases under consideration. In addition there is an X-Ray Conference each Saturday afternoon from 1:00 to 2:00. This has proved a most satisfactory conference for it serves as a forum, familiarizing all members of the staff with the interesting cases under treatment in the many departments of the hospital.

When films are being interpreted daily, the interesting cases are listed for our Saturday meeting. During the middle of the week the program is made up, usually consisting of approximately 6 cases. These are of different types, so that various departments of the hospital are represented. The referring ward officer presents the case history briefly, after which the x-ray findings are demonstrated by a member of our staff. There is then a general discussion which is guided by a member of the X-Ray

Fig. 5. Four exposures of the right side of the pelvis, all of the same subject, made with constant kilovoltage but with filters varying from 1 to 4 mm. of aluminum, the exposure time being determined by the Morgan meter. No significant difference in detail could be noted. The increase in filtration required a very definite increase in exposure time, however.

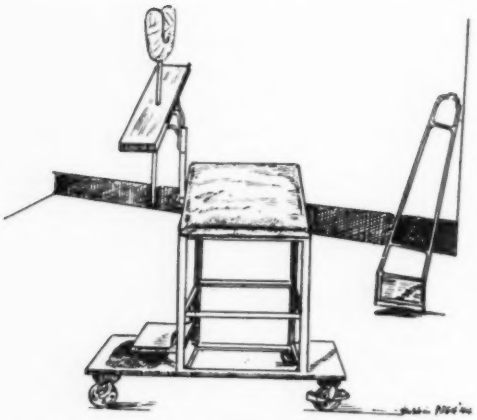

Fig. 6. Chair used in pneumoencephalography. The cassette-supporting arm used with the field unit is shown on the right. Drawing by Major Heublein.

Department, pertinent questions being asked in order to bring out points of importance and to encourage younger members of the hospital staff to take part. We have found the greatest interest in cases in which the diagnosis has not been determined at the time of presentation. Such cases are brought up for discussion at later conferences, with reports of further findings until the diagnosis is determined with certainty.

We are guided entirely, in the time given to the discussion of each case, by the interest of the audience. Seldom are all cases on the program presented, for the discussion is entered into freely by many of those present.

Considerable teaching is carried on in the department at all times, particularly for young physicians who are assigned temporarily to the hospital for instruction, especially in anesthesia and neurosurgery.

An attempt will be made to give an idea of some of the work that goes on in our department. A summary of the incidence of the various diseases in a hospital of this type is of little value, since the patients are filtered out from large numbers in many other institutions. For example, in the first one hundred upper gastro-intestinal examinations that were done, 59 per cent of the patients from overseas were found to have duodenal ulcers. This incidence is higher than would be expected in civilian practice; it is due to the accurate work that is being done in other Army installations in this country and abroad, only those cases with positive findings being transferred to us.

We have selected for consideration some conditions that have proved to be of most importance in causing disability in soldiers, together with a few of the rarer lesions that have been observed.

### THE CENTRAL NERVOUS SYSTEM

Encephalography is widely used in this hospital in the study of cerebral disorders. This is particularly true in cases of cerebral trauma, including concussion where there is no external evidence of damage to the structures overlying the brain. It is also used in patients with fractures and defects in the skull resulting from gunshot wounds, to determine whether or not the brain has been affected, and the extent of the damage.

The neuropsychiatric department makes use of encephalography in many cases and has been rewarded by finding organic brain damage of various types, together with developmental anomalies, in cases previously diagnosed as psychoneuroses, the organic changes in the central nervous system apparently accounting for the abnormal psychogenic manifestations. This department also has been alert in its search for other organic disease in patients sent here as psychoneurotics, and a significant percentage of lesions, such as duodenal ulcers and abnormalities of the urinary tract and chest, have been discovered that could well explain the symptoms.

We use a special chair in encephalography, illustrated in Figure 6. This chair was described by one of us (J. C. B.) elsewhere (1) and has been most satisfactory. It is readily adjustable to a patient of any size, from a very young child to a large adult. It can be moved easily from one part of the department to another and is the same height as the x-ray table, thus facilitating shifting of the patient from the

chair to the table in order that films may be made in the conventional manner.

With the above apparatus, encephalography can be done with great ease and rapidity, the average examination taking approximately fifteen minutes from the time the needle is inserted until all of the films have been made. A special cassette-holding arm has been made for use in combination with the Army field unit. It is illustrated in Figure 7 and is valuable in encephalography where lateral and postero-anterior films are routinely made with the patient upright. A stationary removable grid is a part of this apparatus and the films secured are of excellent quality.

The lumbar puncture is done with the patient sitting in the chair. After the first 30 c.c. of oxygen have been injected, a lateral view of the skull is made, with the use of the field unit and cassette-holding arm above described. Double the usual exposure is given in order that the film may be examined during processing, to ascertain whether or not the ventricles are filling and to determine their approximate size. This is generally done about one minute after the film is placed in the developer. The injection of oxygen continues in the meantime, in the average case approximately 70 c.c. being used. If there is no indication for injecting a larger amount of gas, the needle is withdrawn, and films are made in the lateral and postero-anterior positions with the patient upright. The chair is wheeled to the side of the table and the patient is shifted to the table and placed in a supine position. A horizontal exposure is then made with the forehead up, using the field unit and cassette-supporting arm. This insures filling of the anterior portions of the third and lateral ventricles. Stereoscopic films are next made in the antero-posterior position with the regular stationary unit. The patient is then turned to the prone position with the forehead down, and an exposure is made with a horizontal ray, again with the mobile unit. This insures filling of the posterior parts of the third and lateral ventricles. Stereoscopic films are next made with the stationary machine, in postero-anterior and right and left lateral positions. This technic has proved to be very satisfactory except in rare instances where special exposures are required.

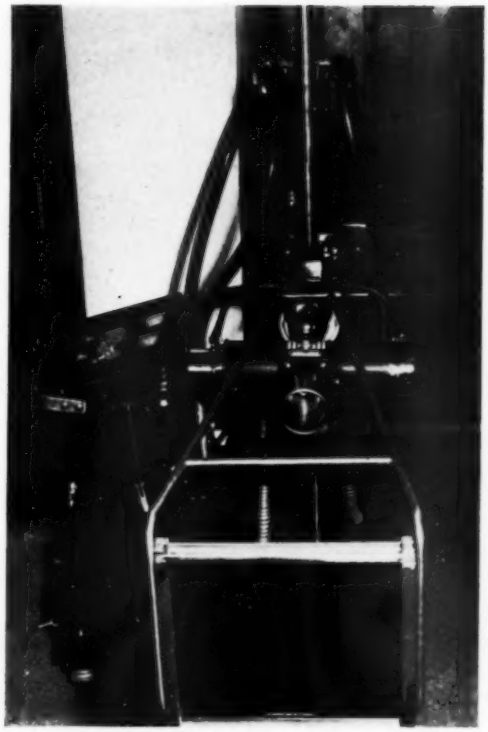

Fig. 7. Cassette-supporting arm used in pneumoencephalography and in making lateral films in myelography, attached to the Army field unit.

A small number of brain tumors have been demonstrated, usually by ventriculography. Pituitary tumors have been relatively common, as might be expected in the age group with which we are dealing.

The following are illustrative cases:

CASE 2: A 29-year-old nurse was admitted to Percy Jones General Hospital Dec. 23, 1943, with a history of severe headaches since Nov. 10, 1943, when she was on duty in England. There was definite evidence of increased intracranial pressure. Ventriculography (Fig. 8) showed distortion of the ventricular system, apparently due to a tumor lying close to the midline, protruding slightly more to the right than to the left. It appeared to be primary in the posterior part of the third ventricle or in the immediately surrounding structures. A crani-

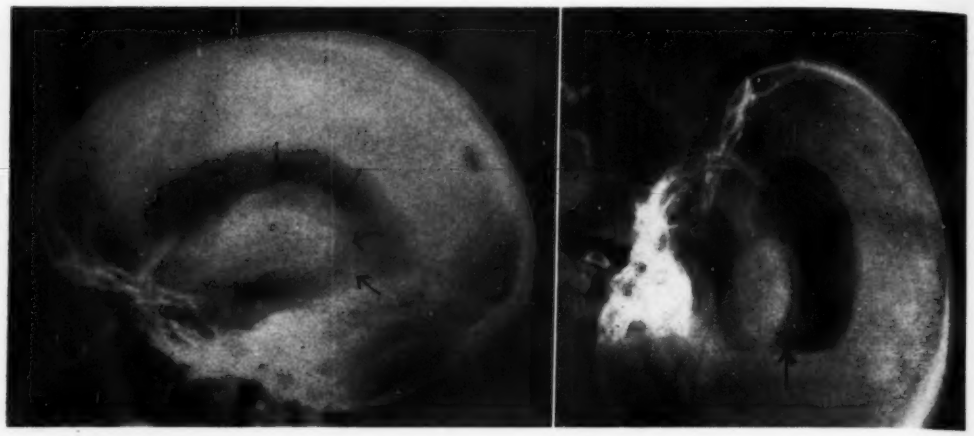

Fig. 8. Case 2: Tumor projecting into the lateral ventricle and blocking the posterior part of the third ventricle, indicated by arrows.

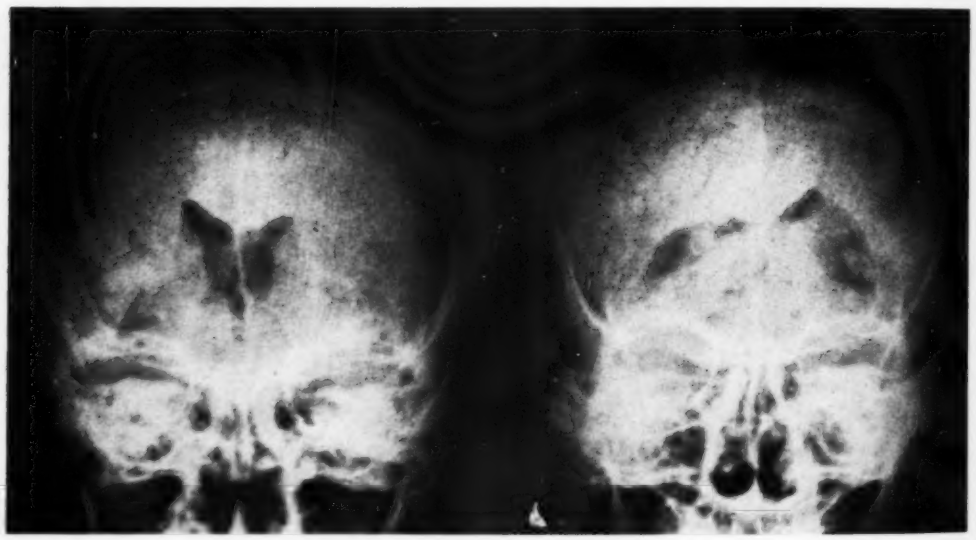

Fig. 9. Case 3: Anteroposterior and postero-anterior views of gas-filled lateral ventricles. Exposure on right is reversed. The deformity of the left lateral ventricle indicates that the encroaching lesion is in the mid or posterior parietal area.

otomy was done Dec. 28, 1943. The right lateral ventricle was entered and was found to be full of blood. A very soft tumor was found that was considered to be characteristic of a glioma. No biopsy was taken because of the patient's condition. She has been given heavy irradiation over four fields but has shown no improvement.

CASE 3: A 35-year-old technical sergeant gave a history of jacksonian convulsions involving the right hand for six years, with progressive weakness of the right hand for a period of one year. Encephalography, (Fig. 9) showed depression of the left lateral ventricle with shift of the midline structures to the right, suggesting a parasagittal meningioma. No cutaneous angiomata were present. On Dec. 22, 1943, craniotomy disclosed a cavernous hemangioma with many vermiform channels crossing through the subarachnoid space. The hemangioma covered an area approximately 3 inches in diameter. One large vein carrying red blood disappeared out of the field in the region of the rolandic fissure. A drawing made at the time of operation is shown in Figure 10.

Fig. 10. Case 3: Drawing made at operation showing cavernous hemangioma in left parietal area.

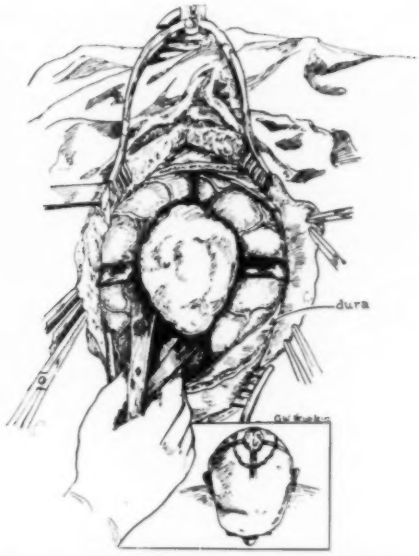


Fig. 11. Case 4: Drawing made at operation showing large meningioma with sarcomatous change.

The lesion was found to be inoperable and the patient was referred for deep x-ray therapy. A total of 2,000 r was given to each of three fields between Jan. 6, 1944, and March 3, 1944, and definite clinical improvement was evident at the time of discharge to a Veterans' Facility.

CASE 4: A 27-year-old private was admitted to Percy Jones General Hospital, July 27, 1943, having first noticed a mass in the occipital area three months prior to admission. It had increased rapidly in size, being approximately half the size of an ordinary orange when first seen here. Six weeks before entrance the patient began to suffer from occipital headache that radiated into the frontal area and he complained of attacks of dizziness aggravated by sudden changes in position. One month before admission the mass was aspirated and cholesterol crystals were said to have been obtained Physical examination at this hospital showed bilateral nystagmus with bilateral sixth nerve weakness. Moderate papilledema was noted, and there was diminution in the corneal reflexes on both sides. Our x-ray examination, as well as one done before admission, showed a large irregular area of destruction in the region of the torcular. The margins of this area were moth-eaten in appearance and in our report it was stated that the defect suggested bone destruction due to an underlying meningioma, possibly with secondary malignant change. The same diagnosis was also suggested in a report made before the patient was sent to this hospital. At operation a very large meningioma, shown in Figure 11, was found. There was definite invasion of the adjacent bone. Microscopic section showed sarcomatous

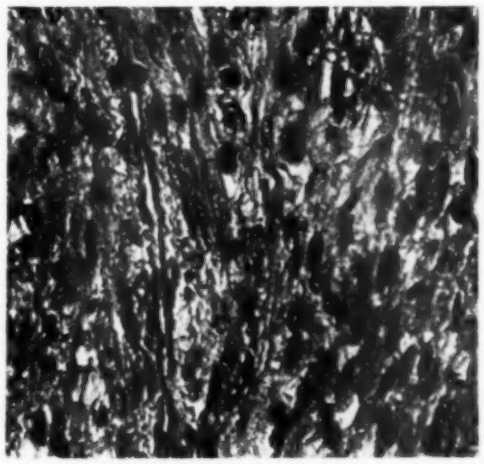

Fig. 12. Case 4: Sarcomatous meningioma. High-power photomicrograph showing spindle-cell morphology and occasional mitoses.

change in the meningioma (Fig. 12). The patient was given heavy radiation between Aug. 23 and Nov. 22, 1943, but died Dec. 13.

Myelography is much in demand, the most frequent indication being symptoms suggesting a herniation of the nucleus pulposus. Many such lesions have been found and removed, with satisfactory post-

operative results in most instances. In one case this procedure was invaluable in confirming the clinical impression of an epidural abscess. The case history and roentgen findings follow:

CASE 5: A 21-year-old corporal gave a history of having a furuncle over the left clavicle Sept. 14, 1943. With conservative treatment drainage took place four days later. The patient did well for one week, when he began to suffer from constipation, dizziness, malaise, and left upper quadrant pain. The diagnosis of a perirenal abscess was considered, but subsequent papilledema and stiffness of the neck led to the diagnosis of epidural abscess, which was confirmed by myelography. The spinal fluid showed xanthochromia.

The white count in the spinal fluid was 10,300 and there were 30,000 red blood cells per cubic centimeter. Physical examination showed weakness of the lower extremities. The knee jerks were absent and the ankle jerks hyperactive. Myelography showed a block at the level of the eighth thoracic vertebra, as shown in Figure 13. A laminectomy was done immediately, the field of operation extending from the eighth thoracic vertebra to the second lumbar vertebra. A large epidural abscess was encountered, which was drained. The convalescence was somewhat stormy, but complete recovery took place.

Prior to 1928 the mortality from epidural abscesses was 70 per cent, but present figures indicate that 33.3 per cent of the patients recover completely, 33.3 per cent recover but have residual paralysis, and the remainder die. The staphylococcus is usually the infecting agent, as in our patient.

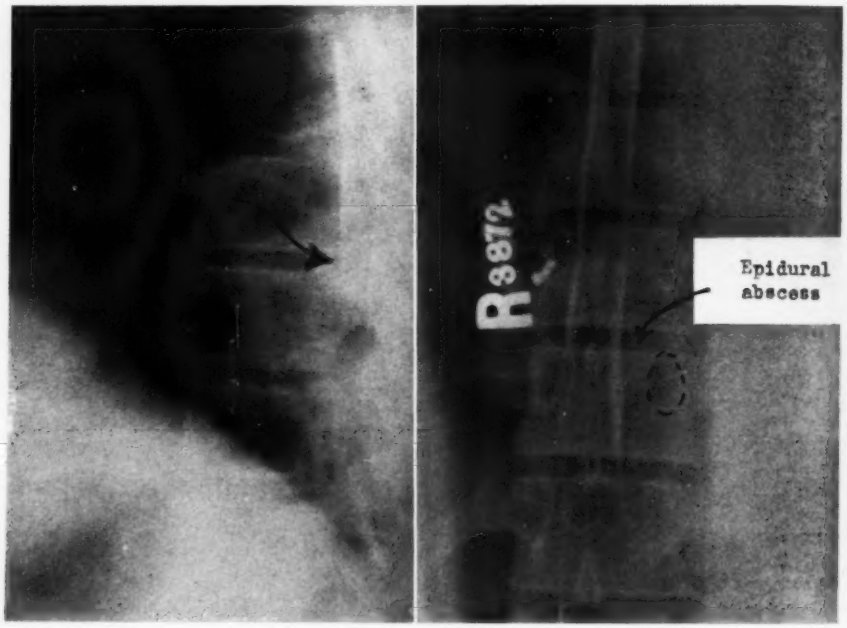


Fig. 13. Case 5. Anteroposterior and lateral views of dorsal spine showing block of subarachnoid space at the level of the eighth thoracic vertebra. The column of opaque material is displaced toward the right in the area indicated by the arrow. Block due to large epidural abscess.

The most important requirement from the radiographic standpoint in satisfactory myelography is an adequate number of films made in the anteroposterior projection, with the column of contrast material passing over each interspace, in any area that may be under suspicion. This insures varying degrees of filling at each interspace. Some lesions are difficult to demonstrate when the column is broad and dense but may be obvious when only a small amount of contrast material is present. Exposures in the lateral projection are also essential.

They are best made with the patient prone, with a horizontal ray. Most satisfactory views of any part of the spinal canal can be secured with the mobile unit and cassette-supporting arm described and illustrated in the discussion of encephalography. The method of examination and type of film obtained are shown in Figure 14.

The lumbar puncture, while not the direct responsibility of the radiologist, is an important consideration. The puncture should be done with the least possible trauma, the point of the needle being in the mid-line, well down near the ventral margin of the subarachnoid space. Trauma from an improperly done puncture may cause a defect in the column of contrast material simulating that caused by a herniated nucleus. It is needless to say that a subdural or extradural injection of the contrast material makes the examination of no diagnostic value. A third essential consideration in accurate diagnosis is a correlation of the roentgen, orthopedic, and neurologic findings. The importance of this cannot be over-emphasized.

Fig. 14. Upper exposure shows the opaque column at the lumbosacral joint space. The presence of an encroaching lesion is manifest only by slight displacement of the column to the right, a small crescent-shaped filling defect on the left, and slight elevation of the adjacent axillary pouch. The exposure at the bottom of the illustration (the same case) shows the type of lateral film that can be secured with the method above described. There is posterior displacement of the column of opaque material and a small ventral filling defect at the level of the lumbosacral joint. A herniated nucleus pulposus was found at operation on the left at the level of the fifth lumbar interspace.

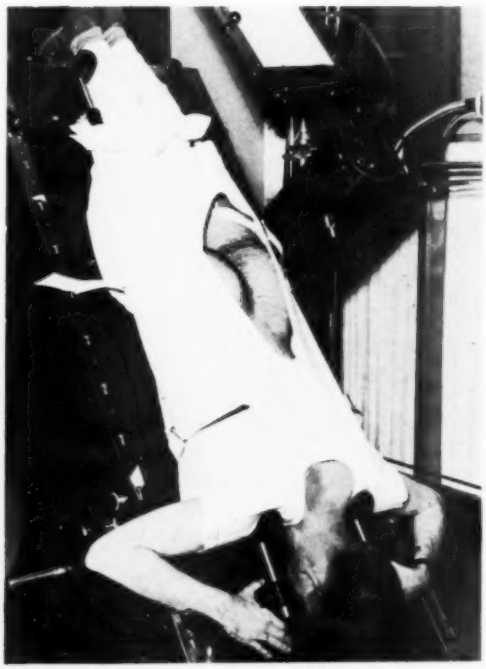

Fig. 15. Canvas support used in examination of the dorsal and cervical portions of the spinal canal.

The examination of the proximal part of the spinal canal is greatly facilitated, by a canvas support (Fig. 15), designed by Major Frank H. Mayfield, Chief of the Section of Neurologic Surgery in our hospital. Heavy canvas straps are attached to the ends of the sling. As shown in the figure, these are made fast to an extra shoulder support that was available but they can be fixed to any other piece of apparatus insuring safe weight-bearing. After the straps

are fixed to the support, they are tied about the patient's legs in order to hold them firmly. The illustration shows a support in the shoulder region bearing some weight, but this is not essential. With this sling, even a paralyzed patient can be examined at any angle up to the perpendicular with complete safety.

When the cervical spinal canal is being examined, the chin is raised and extended. This aids in preventing the contrast material from passing from the cervical region into the fluid spaces within the skull. The table is then tilted, lowering the head until the column of contrast material passes the highest point in the dorsal portion of the spine, after which it is rapidly returned toward the horizontal. The contrast material will remain in the cervical portion of the canal, where it can be examined with the patient at various angles, as would be done in the lumbar region. It is necessary to raise the patient almost to the standing position before all of the opaque material will return to the lumbar area. We are indebted to Lt. Col. Aubrey O. Hampton and Lt. Col. R. Glenn Spurling, of Walter Reed General Hospital for the above method of examination.

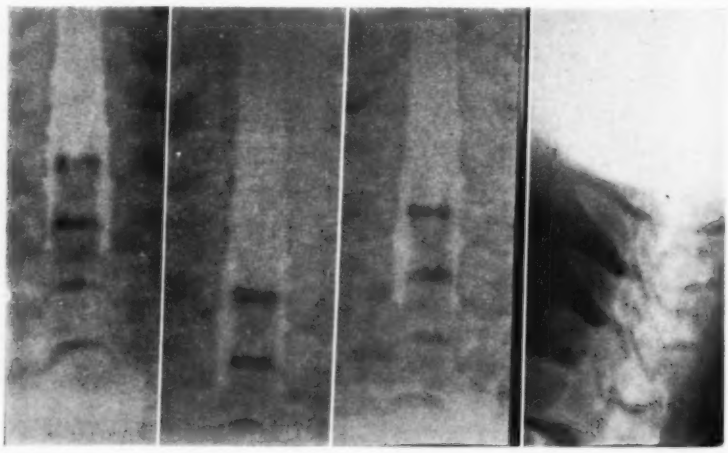

Fig. 15A. Case 5A: Cervical myelogram showing block of cervical canal at level of fifth cervical vertebra. The patient was in an inverted position with the head down and was almost perpendicular. Each of the serial exposures apparently shows the block at a different level. This is due to a shift in the position of the film, the obstruction being at the level of the fifth cervical vertebra.

Pantopaque (ethyl iodophenylundecylate) is the contrast material used in all of our myelograms. It is routinely removed immediately after completing the radiographic examination. This usually can be accomplished with very little difficulty.

The case history, roentgen findings, and operative findings in an unusual case of herniated nucleus pulposus in the cervical area follow.

CASE 5A: A 32-year-old Negro male entered our hospital having had symptoms for ten months prior to admission, including numbness and tingling in the right hand and a gradually developing spastic right hemiparesis beginning in the right arm and spreading to the right leg. The muscles of the hand were paralyzed and the patient complained only of a dull aching sensation in the right shoulder. There was no history of trauma.

The patient was well developed and well nourished, with a spastic paresis of the right leg and a mixed spastic and flaccid paralysis of the muscles of the right hand. There was loss of pain and temperature sensation on the left side of the body, a typical Brown-Séquard syndrome being present. The spinal puncture done at this hospital showed a complete obstruction of the canal, demonstrated by the Queckenstedt test. Spinal puncture and a myelogram done elsewhere, one month prior to admission to this hospital, were said to have been normal. Myelography was done, with 6 c.c. of Pantopaque, this amount being used routinely in our

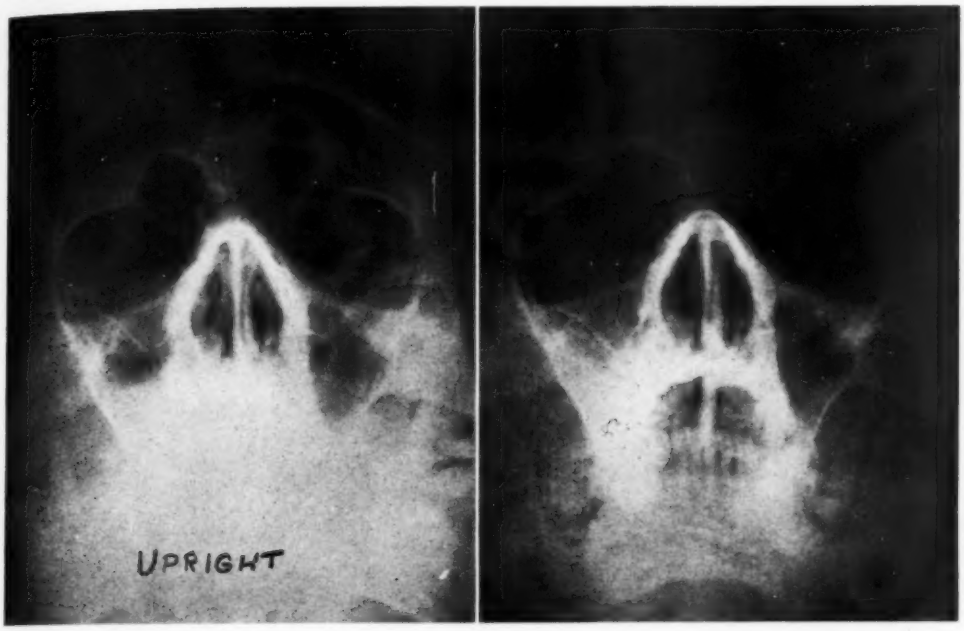


Fig. 16. Exposure of anterior sinuses in the Waters position, with the patient horizontal and upright. General clouding of the right antrum shown with the patient horizontal. Fluid level demonstrated in the upright exposure.

cervical myelograms. The progress of the column through the canal was entirely normal until it reached the level of the lower margin of the fifth cervical vertebral body. Here the column split and passed upward along each side of the canal to the level of the upper margin of the fifth cervical vertebral body, where the progress was completely arrested. At this time the patient was almost perpendicular, his head being down and his chin completely extended. There was no pulsation in the column of material and no movement upon coughing. It was obvious that there was a complete block, the lower margin of which was at the level of the lower margin of the body of the fifth cervical vertebra. It was our opinion that a tumor of some type was present, blocking the canal. Major Mayfield thought that the tumor was probably intradural but extramedullary, while we, in the x-ray department, thought that it was probably intramedullary. Our findings are shown in Figure 15A; the cephalic portion of the canal is at the lower margin of the illustration, indicating the position of the patient when the exposures were made.

At operation a large herniated nucleus pulposus was demonstrated at the level of the interspace between the bodies of the fourth and fifth cervical vertebrae. The adjacent nerve roots were not compressed thereby, accounting for the absence of pain. The cord, however, on the right side was markedly compressed. The laminae of the fifth and sixth

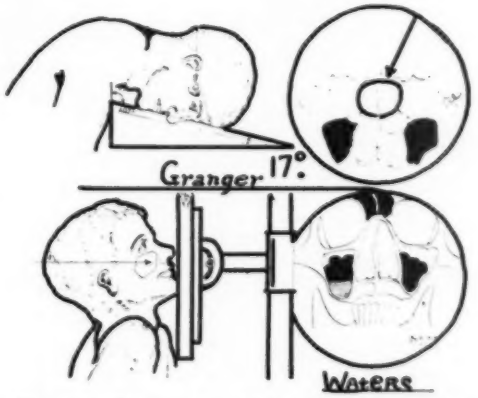


Fig. 17. Diagram by Major Heublein showing proper positioning for Granger view of sphenoids and for upright view of anterior sinuses in Waters position.

vertebrae were removed, for it had been anticipated that the lesion was a new growth and not a herniated nucleus pulposus. The herniated nucleus was removed. The patient's convalescence has been uneventful and he has shown a progressive return of function since operation.

This case seemed to us to be of unusual interest because of the slow progression of

symptoms without significant pain and with no history of trauma. We have seen one other case, demonstrated by myelography, where there was a complete block at the level of the fifth dorsal vertebra.

Fig. 18. Routine exposures used, with the exception of the upright. Anterior sinuses on the right normal. Those on the left show evidence of extensive disease. Posterior sinuses are all clear.

The obstruction was thought to be due to a new growth but at operation was shown to be the result of a herniated nucleus pulposus.

### ACCESSORY SINUSES AND FACIAL BONES

Examination of the nasal accessory sinuses is done in all patients suffering from asthma and all others where such an examination appears to be indicated. Stereoscopic films are made in the Waters position with the patient horizontal, and a single film in the same position with the patient upright. The latter film (Fig. 16) is valuable in demonstrating fluid levels and in determining whether increase in density is due to mucosal thickening, to fluid, or to a combination of these two conditions. The Granger position (Fig. 17) is

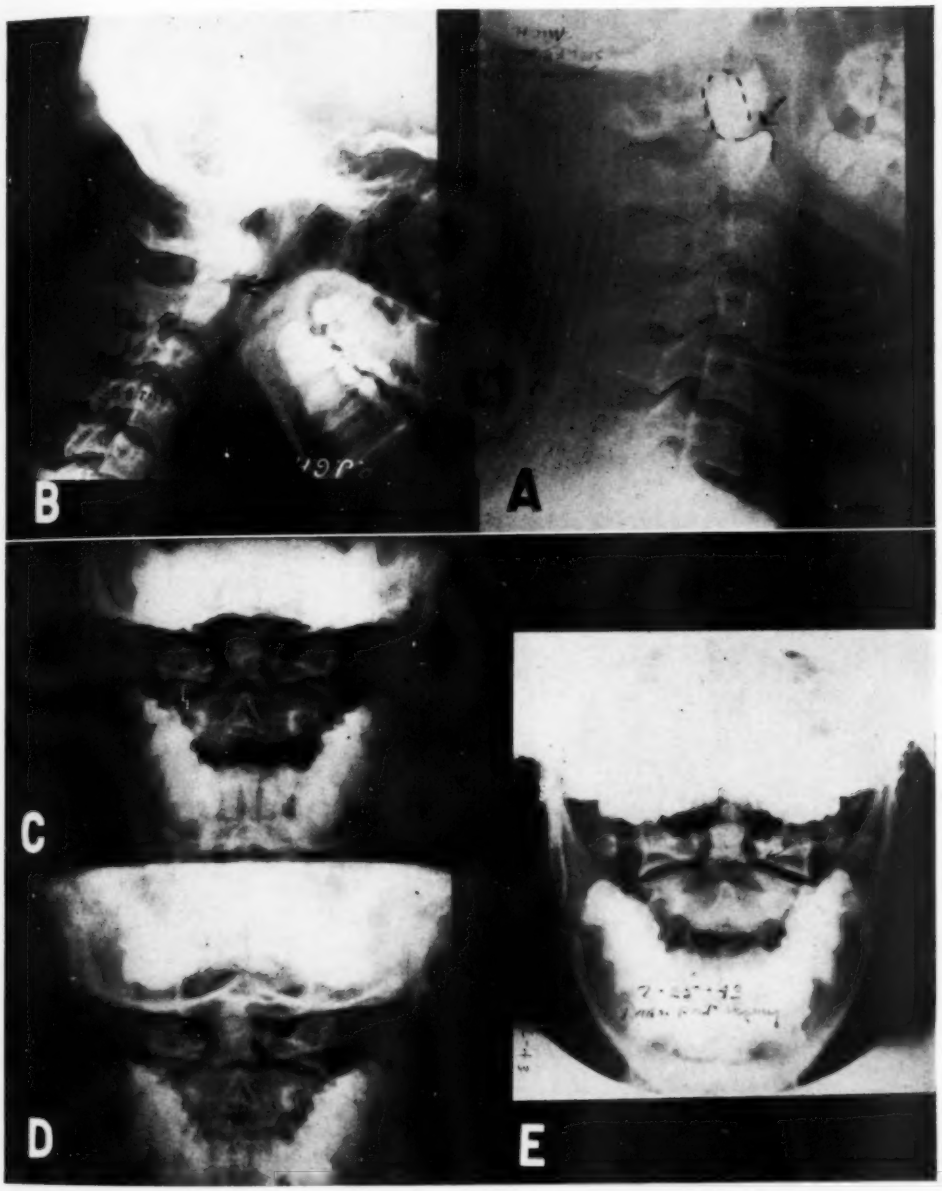


Fig. 19. Case 6: Fracture of base of odontoid process of second cervical vertebra. A. Posterior dislocation and fracture prior to reduction. B. Position of parts after reduction. C and D. Exposures of first and second cervical vertebrae through open mouth, made shortly after injury, showing fracture through base of dens. E. Similar exposure one month after injury. Some demineralization has apparently taken place during the interval between examinations.

used for visualization of the sphenoids and posterior ethmoids, the former sinuses also being shown in the Waters position, where the exposures are made with the mouth open. The frontal sinuses and anterior ethmoids are examined in the Caldwell position. A lateral exposure of the entire sinus area is also secured. This routine,

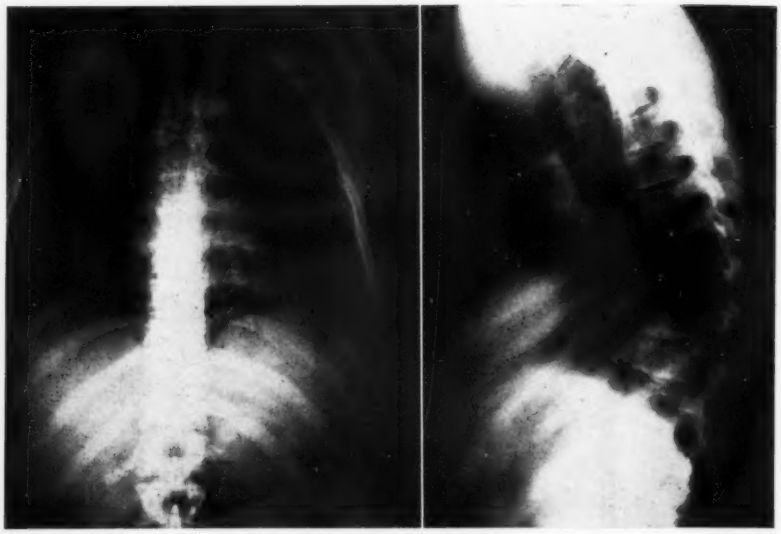

Fig. 20. Changes characteristic of an advanced Scheuermann's disease in the dorsal spine. The changes are particularly marked in the vertebral bodies indicated by arrows.

Fig. 21. Case 7: Tuberculosis of the dorsal spine, with paravertebral abscess and destruction of the vertebral bodies.

shown in Figure 18, has proved very satisfactory and with such films a high degree of accuracy in diagnosis is possible. Sinus disease in itself has not been a very important permanently disabling condition in our patients but has been quite significant from the standpoint of temporary disability.

A number of severe traumatic lesions of the bones of the face have been seen. In demonstrating these, films are made in the Waters position together with lateral stereoscopic views. Such an examination is most satisfactory in the majority of instances. Experience teaches one the type and number of fractures that are likely to be encountered. For example, when there is a fracture of the zygomatic arch or separation at the joint between the temporal process of the malar and malar process of the temporal, there usually are fractures of the superior and inferior walls of the adjacent antrum. Bilateral fractures of this type are not uncommon.

### THE SPINE

We have seen a large number of severe traumatic lesions of the cervical spine, the common ones being fractures of the cervical vertebral bodies, at times with associated fractures of the adjacent posterior processes with or without dislocations, fractures of the odontoid, and in a few instances rotary dislocations of the first cervical vertebra. The latter are sometimes produced by a cervical adenitis which causes relaxation of the ligamentous structures with subsequent spontaneous rotary luxation of the atlas on the axis. It is well to bear in mind the fact that fractures of the odontoid process may become evident only after calcium absorption about the fracture has taken place and may not be demonstrable before ten days to three weeks following the initial trauma.

The following case is illustrative of a fracture of the base of the odontoid.

CASE 6: A 26-year-old private, first class, gave a history of having been thrown from a truck and landing in an unknown manner. He was unconscious for a period of twenty-four hours and had difficulty in swallowing after he regained consciousness. Physical examination showed hyperactive reflexes in the left arm and limitation in motion of the cervical spine. X-ray examination showed a fracture through the base of the dens with posterior displacement. Head traction for a period of six days resulted in satisfactory reduction, and a plaster cast including the upper part of the thorax, the neck, and the greater part of the head was applied. Disability for a period of from four to six months is anticipated. Figure 19 shows the fracture in the lateral projection before and after reduction, as well as anteroposterior views of the fracture through the open mouth.

Fig. 22. Spondylolisthesis, second degree. Exposure of lumbosacral area using small diaphragm. Defects in posterior processes well shown.

In the dorsal region bone and joint changes resulting from a juvenile epiphysitis, known as Scheuermann's disease, shown in Figure 20, have been found not infrequently in patients complaining of back pain. Many of the vertebral bodies have been quite noticeably deformed, and secondary hypertrophic changes have often been present. From the standpoint of dis-

Fig. 23. Case 8: Diffuse calcification in the kidneys and cystic changes in femur and ilium in a patient with a parathyroid adenoma. There were cystic changes in other bones, including minute areas of calcium absorption throughout the skull.

ability in soldiers, the significance of this condition has not been determined with certainty.

A typical case of tuberculosis of the dorsal spine with a paravertebral abscess is shown in Figure 21. The case history is as follows:

CASE 7: A 23-year-old private, first class, was admitted to Percy Jones General Hospital on Sept. 25, 1943, giving a history of pain in the dorsal area which he noticed two weeks after induction. When ordered to do double time in drill, he fell to the ground, was hospitalized, but after a brief period returned to his duties. He began to lose weight and continued to complain of pain in the lower dorsal region. He was again hospitalized, at which time he was found to have an afternoon fever. He was transferred to this hospital with a diagnosis of chronic perinephritis. Examination of the urine revealed nothing abnormal. Our x-ray examination showed destruction of portions of the bodies of the ninth, tenth, eleventh, and twelfth dorsal vertebrae with the typical paravertebral abscess shown in the illustration. A spinal fusion was done Nov. 17, 1943. The postoperative course was uneventful, and the patient was discharged to the Veterans' Facility for further care.

In the lumbar region, the most common disabling condition found has been herniation of the nucleus pulposus, usually at the level of the fourth or fifth lumbar interspace. All patients suspected of having this condition have had myelograms done.

Another lesion of the lower spinal area that has proved to be of decided importance in the Army has been spondylolisthesis. It is the opinion of our orthopedic staff that spondylolisthesis, even of the first degree, may cause relatively severe disabling symptoms. The developmental defects in the pars interarticularis have been best shown in the lateral projection using a small cone, one covering an 8 × 10-in. film at a 30-inch focal distance. A typical example is shown in Figure 22.

BONES AND JOINTS

Some tumors of the bone have been found. There have been four endothelial myelomas, one osteogenic sarcoma, a few metastatic lesions of bones secondary to malignant tumors elsewhere, and one case of cystic disease of the bone secondary to a parathyroid tumor. Illustrative cases follow.

CASE 8: A 23-year-old technician, fifth grade, gave a history of having passed a small urinary calculus in the summer of 1939 and recovered satisfactorily. He was well until August 1943, when he experienced indefinite pain in the lower back and a sense of soreness in the region of the left ilium. In September he was somewhat nervous and on Sept. 14 was first hospitalized because of pain in the left hip. Some relief resulted from sedatives and local application of heat. X-ray examination showed diffuse calcification throughout the kidney areas and cyst-like areas of decreased density in the right ilium, the proximal third of the right femur, and in the neck and the distal third of the left femur. These changes were considered characteristic of hyperparathyroidism.

Examination at this hospital revealed the changes noted on examination prior to admission. Intravenous studies of the urinary tract showed essentially normal function and collecting system. The calcium deposits were in the kidney parenchyma.

Examinations on Oct. 29 showed the red cell count to be 4,100,000, white cell count 8,500, hemoglobin 78 per cent, blood phosphorus 3.4 mg. per cent, blood phosphatase 22 units, and serum calcium 18.7 mg. per cent.

Operation, Nov. 8, 1943, revealed a large, firm, grayish mass lying behind the left lobe of the thyroid. Frozen section showed this to be a tumor of the left parathyroid gland. The tumor was removed. The right parathyroid was examined and was thought to be slightly hypertrophied but was not removed. The postoperative course was uneventful except for generalized joint pains associated with moderate elevation of the temperature, swelling, redness, and pain on movement of various joints. The serum phosphate fell promptly. The fall of the serum calcium was slow, but both were normal by the third postoperative day. There was a gradual rise in the serum phosphate after the twelfth postoperative day, the highest point being reached approximately six weeks after operation, when the serum phosphate was 4.5 mg. per cent and the serum calcium 12.5 mg. per cent. The serum calcium had been 15.3 mg. per cent the previous day. These were the highest readings obtained at any time. The last blood examination was done March 7, 1944, when the serum phosphate was 3.0 mg. per cent and the serum calcium 12.4 mg. per cent.

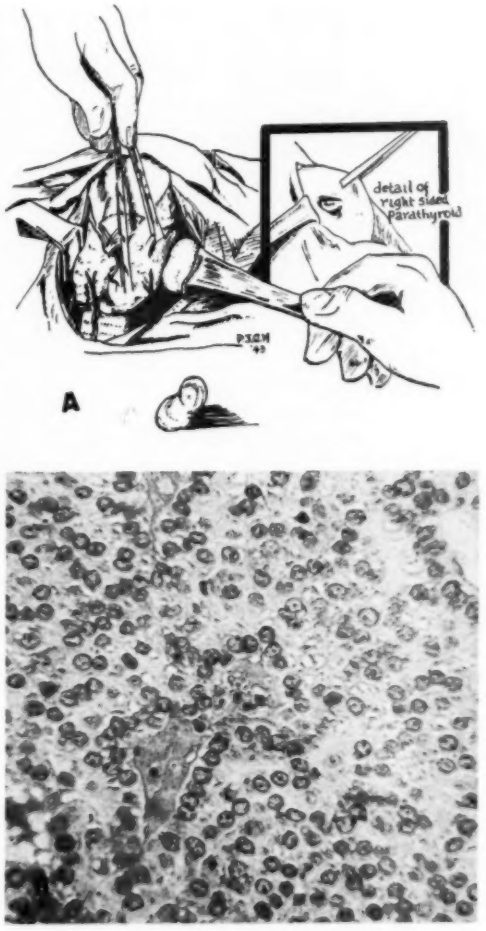


Fig. 24. Case 8: A. Drawing made at operation showing tumor of left parathyroid lying posterior to the left lobe of the thyroid, which was retracted. Right side shown for comparison. B. Photomicrograph of parathyroid adenoma, chief-cell type. Section reveals typical adenoma of parathyroid, showing densely massed cells with formation of occasional alveoli containing colloid-like secretion.

The patient is having no symptoms at the present time, but repeated x-ray examinations have shown no appreciable change in the lesions of the bones or kidneys. Our findings in this case, including a drawing of the tumor, are shown in Figures 23 and 24.

Another unusual bone lesion is shown in Figure 25.

CASE 9: A 19-year-old Negro private was admitted to Percy Jones General Hospital Sept. 3,

1943, with a history of pain in both thighs and the lower abdomen since July 21, 1943. He was admitted to the Station Hospital, Fort Custer, from the Reception Center because of inability to walk. He had a temperature, at the time, of 103° and evidence of a polyarthritis. A presumptive diagnosis of rheumatic fever was made. X-ray examination at the Station Hospital showed a peculiar periosteal reaction along the margin of the femur and one humerus. A biopsy was done and a small amount of pus was found beneath the periosteum. Microscopic examination of the tissue removed showed only inflammatory changes. Following surgery the pain in the thigh disappeared and the patient was transferred to our hospital. Laboratory studies showed 3,500,000 red blood cells with a hemoglobin of 58 per cent. The sedimentation rate was 32 mm. during the first hour. The red cells showed marked sickling and many target cells were found. The patient improved rapidly while in this hospital and was discharged to a Veterans' Facility for further observation.

The above abnormalities, in our experience, are unusual, apparently being the result of a low-grade inflammatory process. The patient had an obvious sickle-cell anemia, but there seemed to be no connection between the anemia and the peculiar bone changes.

Fig. 25. Case 9: Irregular calcium deposits beneath the periosteum of the humerus and femur.

Metastatic bone lesions showing a satisfactory response to radiation are illustrated in Figures 26–28.

CASE 10: A 54-year-old officer gave a history of dull pain in the back that radiated around the lower ribs on the left side, beginning in September 1942. An examination of the gastro-intestinal tract, including the colon, was negative at that time. We found complete destruction of the left pedicle of the tenth dorsal vertebra. A chest film, shown in Figure 26, revealed a small nodular lesion in the left upper lobe that in some ways resembled a tuberculous infection, but the subsequent course seemed to indicate that it was due to a bronchiogenic carcinoma. The patient also complained of pain in the right foot, and films showed a destructive lesion in the cuboid. A biopsy of the area of destruction in the cuboid was done after considerable roentgen therapy, and a metastatic adenocarcinoma of unknown origin was identified. Roentgen therapy was started Feb. 1. The back pain promptly subsided, as did the pain in the foot. Subsequent examinations of the chest showed considerable regression of the lesion in the left upper lobe, the latest films showing only a small area of fibrosis (Fig. 26, D) in the area where quite a discrete mass had previously been demonstrated.

The patient was discharged to duty March 30, 1943. In June 1943, he was still asymptomatic. A

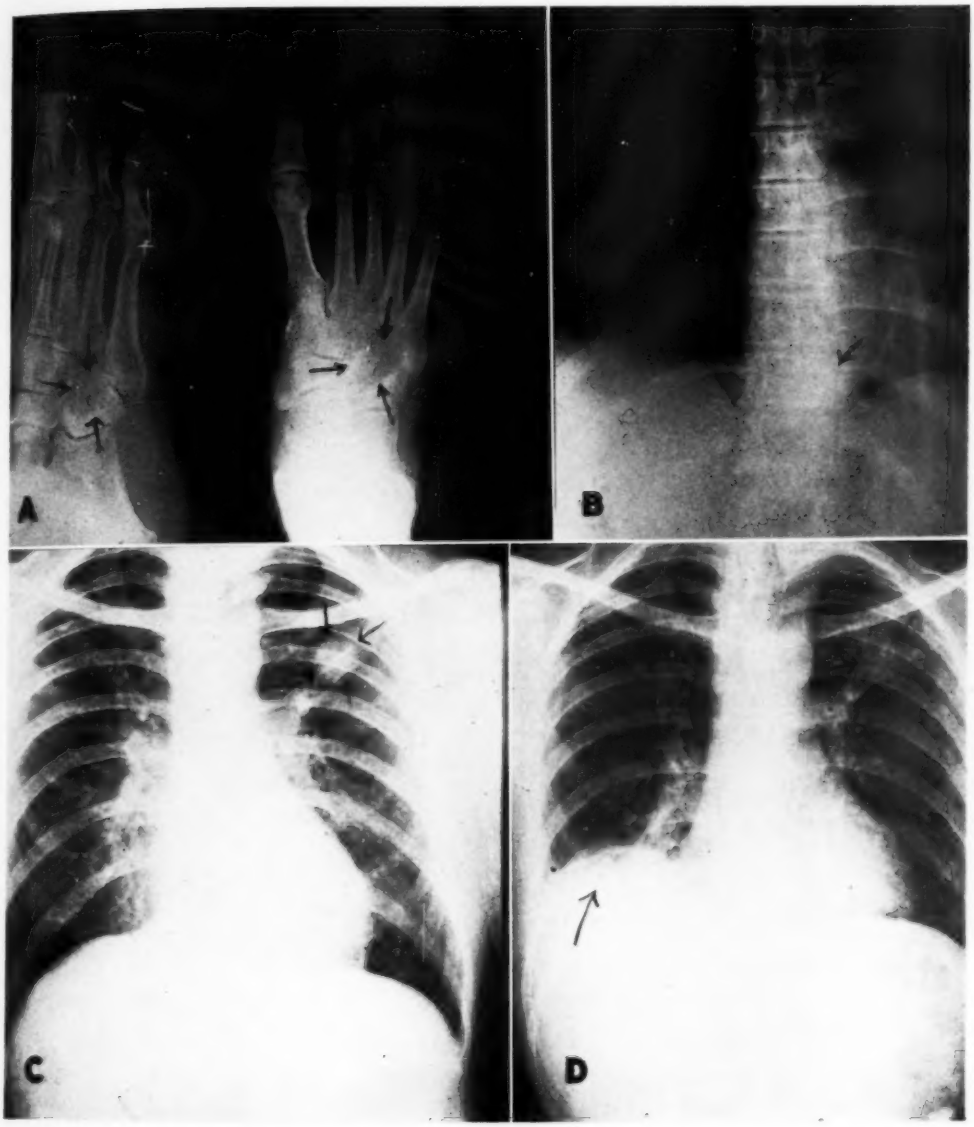


Fig. 26. Case 10: Metastatic carcinoma. A. Area of destruction in cuboid. B. Destruction of pedicle of fifth dorsal vertebra and recalcification of pedicle of tenth dorsal vertebra following irradiation over the latter area. C. Rather sharply circumscribed shadow in left infraclavicular area, apparently due to a bronchiogenic carcinoma. D. Chest eleven months later, following deep radiation therapy over the area of circumscribed shadow in the left infraclavicular region. Only a few linear areas of fibrosis remain. At the time this film was made the patient had an atelectasis of the right lower lobe. He had a cold and refrained from coughing because of sacral pain. Postural drainage resulted in prompt relief of the apparent bronchial obstruction and the lobe became normal.

survey of his bones showed complete healing with recalcification in the tenth dorsal vertebra. However, the left pedicles of the fifth and seventh dorsal vertebrae showed evidence of destruction similar to that previously noted lower down. Roentgen therapy was given over the involved pedicles, and subsequently examination showed healing with recalcification (Fig. 27).

Fig. 27. Case 10: Metastatic carcinoma. Films of the dorsal spine showing recalcification following radiation over involved pedicles.

The patient was readmitted Nov. 22, 1943, because of severe pain in the region of the sacrum. A large destructive lesion of the sacrum was found (Fig. 28). Again deep radiation was resorted to with prompt disappearance of pain. The patient improved rapidly and once more went back to duty. He returned in March 1944, complaining of retro-orbital pain. A survey of the entire skeletal system was done. The lesions in the spine and sacrum had healed, with recalcification, but three areas of destruction were found in the skull. They were similar to the ones earlier observed in the spine and sacrum. The retro-orbital pain disappeared promptly following the beginning of irradiation of the skull.

The arthritides, from a radiographic standpoint, have not been a major problem in our institution. Many cases of polyarthritis have been examined, but except for showing early demineralization, indistinguishable from that seen in disuse, and occasional cystic lesions of the short bones mimicking gout, the radiographic findings in rheumatoid arthritis have been largely negative. This is due to the fact that most cases so far examined have been early.

Spondylitis rhizomélique, also known as atrophic spondylitis or the Marie-Strümpell type of arthritis, has played a much more important role. The histories are quite similar, the most characteristic feature being exposure to abnormal climatic conditions, either in basic training or on bivouac overseas. The following is a typical story.

CASE 11: A 33-year-old soldier dated the onset of his illness from a drenching he received while in bivouac on Guadalcanal in November 1942, when his tent was blown away by a tropical storm. Stiffness in the back and shoulders, neck, and elbows developed and progressed, becoming increasingly painful. His lumbago became so severe that it prevented him from doing duty. On admission to this hospital he complained of stiffness in the entire back and bilateral leg pain. Physical examination showed limitation of motion of the spine in all directions. The sedimentation rate was 74 mm. during the first hour. Roentgenograms revealed atrophic disease involving the entire spine, with the most advanced changes in the sacroiliac joints. The patient had great difficulty in getting on the therapy table. After his first series of treatments with intermediate therapy, prompt improvement took place and he was able to participate in limited physical

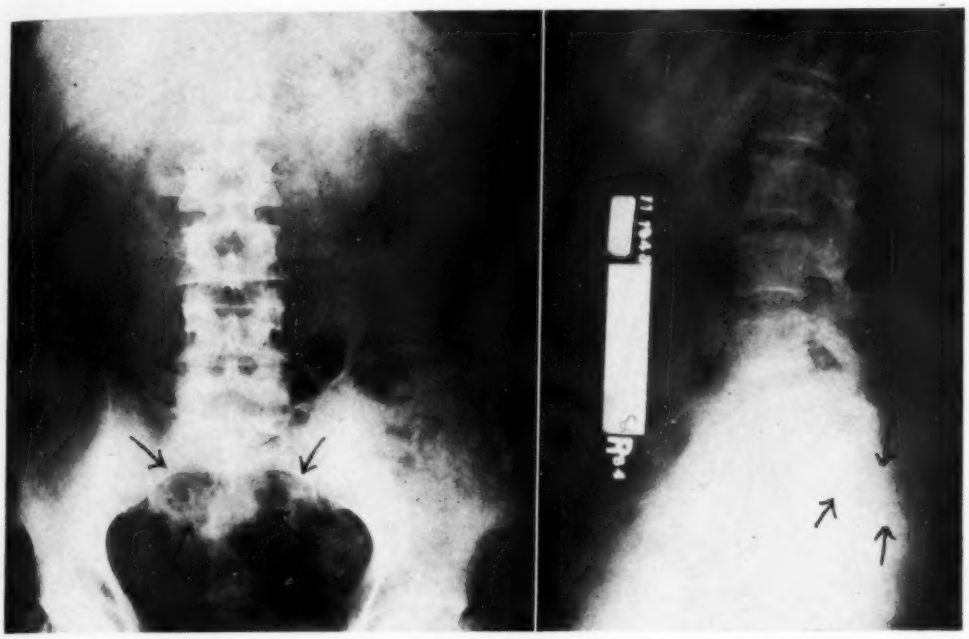

Fig. 28. Case 10: Metastatic carcinoma. Extensive destruction of the proximal half of the sacrum resulting from a metastatic tumor. Prompt relief of symptoms and recalcification followed irradiation over this area.

activities, such as table tennis. His response to irradiation remained satisfactory over a period of several months while he was under observation here.

Approximately 75 per cent of such cases have shown significant improvement following roentgen therapy. Little if any improvement has resulted in those cases with no clear-cut roentgenographic evidence of disease or in those showing no elevation of the sedimentation rate.

Traumatic arthritis of the knees has been a frequent disabling condition, and the radiographic findings have been striking. Besides conventional films of the knee, it is important to include a flexed-knee projection of the intercondyloid fossa in almost every instance. This projection frequently shows the calcification of Pellegrini's disease to better advantage than other views. It is indispensable in demonstrating loose bodies, the defects of osteochondritis dissecans, and other defects in the surfaces of the condyles.

The clinical stories of the patients examined have had much in common. There has been either a fall from a height, direct trauma by a heavy falling object, or, more commonly, a twisting injury often received when playing high school or college football. Following the initial injury there frequently is a history of "locking," or of the knee "giving out." After induction into the Army there usually have been episodes of pain due to recurring hydrarthrosis or on pivoting in close-order drill or in field maneuvers. Physical examination often has indicated the presence of joint mice, crepitus, a thickened capsule, relaxed capsular ligaments, or instability due to a damaged anterior cruciate ligament. The radiographic examinations at times have shown one or more loose osteochondromatous foreign bodies in the joint capsule and defects in the articular surfaces of the condyles.

Pellegrini-Steida's disease and osteochondritis dissecans have been encountered quite frequently in examinations of the knees. Both can cause protracted symptoms and severe disability in men on active

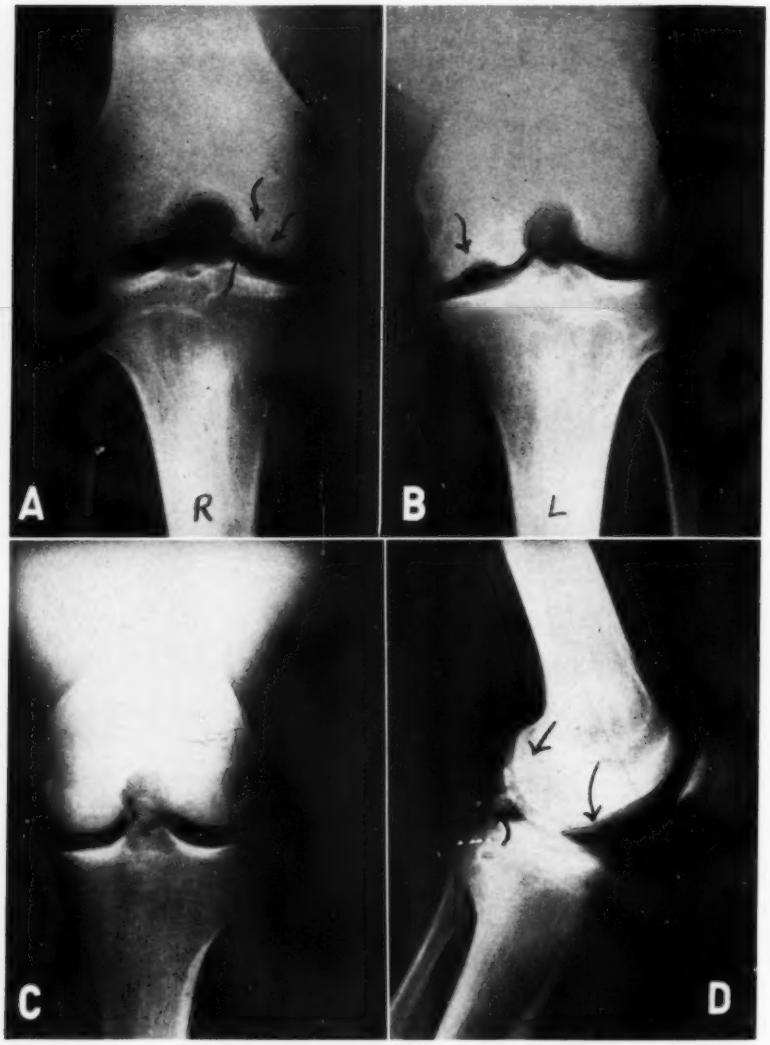


Fig. 29. A and B. Case 12: Bilateral osteochondritis dissecans. A. Partially separated loose fragment indicated by arrows. B. Large defect in articular surface of left femur. C and D. Another case, showing multiple calcified bodies within the knee joint.

duty in the field. It must be borne in mind that either of these may be bilateral, and for this reason the uninvolved joint should be examined carefully.

A typical case of osteochondritis dissecans is shown in Figure 29, A and B.

CASE 12: A 20-year-old private gave a history of injuring both knees in high school and college. He frequently suffered from pain in his knees and at times from "locking." Pain continued after induction and the x-ray films made at this hospital upon admission showed bilateral osteochondritis dissecans. On March 16, 1943, arthrotomy was done on the left. Two large calcified bodies were removed and a large defect in the condyle was curetted. The postoperative course has not been very satisfactory. Pain has continued and there is considerable limitation in the movement of the knee.

Multiple calcified bodies in the knee joint as seen roentgenographically are shown in Figure 29, C and D.

Fig. 30. Case 13: Pellegrini-Stieda disease. A. Region of knee shortly after injury, showing no abnormalities. B. Film made several months after injury, showing evidence of Pellegrini-Stieda disease. Calcification medial to the condyle is extensive.

Fig. 31. Bilateral Pellegrini-Stieda disease together with multiple calcified bodies within the joint space of the knee, shown on the right.

A typical case of Pellegrini-Stieda's disease is illustrated in Figure 30.

CASE 13: A 26-year-old private, first class, gave a history of having injured his left knee in an attempt to avoid a tree while tobogganing. A cast was applied but was removed after one month, when physiotherapy was begun. The knee remained stiff and it was then manipulated under anesthesia. The patient was placed on limited duty at light work, but continued to have symptoms. Physical examination showed atrophy of the thigh and a firm, apparently bony prominence over the internal condyle of the femur. Our examination showed a

Fig. 32. Recurrent dislocation of the right ankle. The right ankle is shown both in inversion and forced inversion, with the normal left ankle shown for comparison.

large irregular deposit of calcium in the periarticular soft tissues medial to the medial condyle. On Feb. 22, 1944, a calcium plaque was removed at operation. The reason for the operation was that the calcium plaque spanned the joint. Ordinarily these lesions are not treated surgically. There was still considerable limitation in the motion of the joint at the time of this report.

One type of joint disability which deserves special mention is recurrent dislocation of the ankle. According to Watson Jones, there is usually a history of chronic strain or instability on walking over rough ground. Sudden inversion of the ankle may cause the patient to fall. A lesion is to be suspected in anyone who complains of turning his ankle frequently following a severe sprain. Conventional roentgenograms may show no abnormality; as a result, the examining officer may conclude that no traumatic changes are present. Films of both ankles made in the anteroposterior position in forced inversion make the diagnosis clear, showing that there has been a tear of the anterior talofibular ligament, permitting a partial dislocation of the astragalus upon forced inversion. Early diagnosis is important and adequate anesthesia may be needed before satisfactory films can be secured. An example of this is shown in Figure 32.

Lateral views are not particularly informative, although an old sprain fracture of either malleolus may lead one to suspect the presence of such an injury. This injury is particularly important in view of the fact that novocain injections are frequently used in the treatment of sprains. Too early use of the damaged part is likely to increase the disability and result in an unstable ankle with recurring subluxations.

This hospital being an amputation center, many stumps are seen. The staff of our orthopedic service is chiefly concerned with the presence of sequestra or spurs in the weight-bearing area. Large spurs do not necessarily indicate an unsatisfactory stump, providing they are not in a weight-bearing area. It behooves the radiologist to be familiar with the various types of good functional stumps in order that he may give the maximum aid to the referring physician. The presence of metallic foreign bodies, fractures, evidences of infection in the soft tissues, and demineralization are reported. In certain instances of painful stump we have found it advantageous to do our examination with the prosthesis in place, with and without weight-bearing.

### THE CHEST

Because of the nature of the work in a hospital of this type, relatively few acute chest infections are seen. We see many more of the sequelae of these infections, such as empyema, a surprisingly large number of cases of bronchiectasis, and an occasional lung abscess. Many of the cases of bronchiectasis apparently are of a relatively acute nature following the so-called atypical pneumonias. A few have been of long standing.

Many patients suffering from empyema have been and are being treated in our hospital. Approximately one-third of these cases have followed atypical pneumonia. It has been thought that empyema as a sequel of atypical pneumonia did not exist or was exceedingly rare, but such has not been our experience. Less than one-third of the cases have been of a miscellaneous

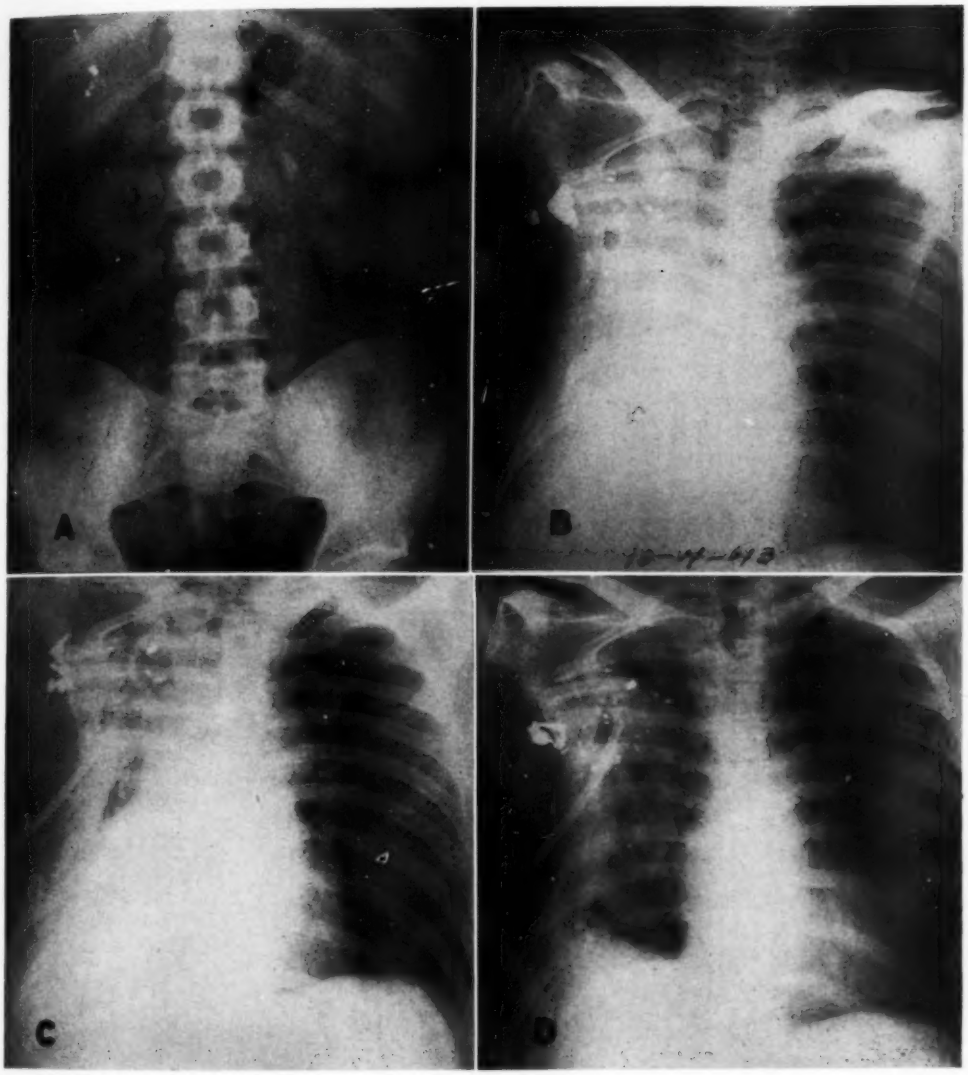


Fig. 33. Case 14: Postoperative atelectasis. A. Stone in left kidney pelvis. B. Film made a few hours after operation, showing postoperative atelectasis. Fragments of shrapnel can be seen, together with changes resulting from the previous empyema and thoracoplasty. The mediastinal structures are shifted to the right. C. Partial clearing of right lung following bronchoscopic drainage. D. Condition of chest forty-eight hours later. The mediastinal structures have returned to their normal position. The right lung is clear aside from the changes resulting from the previous empyema, the thoracoplasty, and the gunshot wound.

nature; a few followed pneumococcus pneumonia, a very few were tuberculous in origin, and in one instance the colon bacillus was the organism found. One-third have followed gunshot wounds of the chest, a hemothorax having first developed, which was followed by secondary infection. Most of the infections have been of long standing when first seen. The purulent material has often been encapsulated, with a thickened pleura surrounding it. Bronchopleural fistula has been a frequent complication.

The results of treatment with open or

closed drainage, suction, and thoracoplasty as indicated, together with breathing exercises, a high-vitamin diet, and careful nursing care, have been most gratifying. A high percentage of these patients have been returned to active duty.

Atelectasis, usually postoperative, is seen occasionally. A case of unusual interest is shown in Figure 33.

CASE 14: A 31-year-old private was wounded by an explosive bullet while on duty in the South Pacific, Nov. 24, 1942. A hemothorax developed, and bleeding was profuse. He was carried on a litter for three days, lying in a swamp at night. Sulfanilamide was applied locally. He was treated at a battalion aid station, evacuated to a hospital one mile farther back, and then flown by plane to another installation, where a chest examination showed fluid on the right. The fluid was aspirated, being largely blood. The wound was said to have been of the sucking type. The chest wound was closed and the patient was transferred to a hospital in Australia. Purulent material was aspirated from the right pleural space at this time. A rib resection was done, a drainage tube was inserted, and the empyema space irrigated with Dakin's solution. The patient arrived at Letterman General Hospital in February 1943, where further operative drainage was done. On March 11, 1943, a diagnosis of malaria was made, the parasite being Plasmodium vivax. Atabrine was given, and the patient was transferred to Percy Jones General Hospital.

A draining wound was present in the right side of the chest. A bronchopleural fistula was demonstrated March 25, 1943, by injecting lipiodol through an intratracheal catheter. The patient improved under medical management. The thoracotomy wound was still open June 10, 1943, and a large residual empyema cavity remained. More adequate drainage was done June 15. Following this operation the patient improved. A thoracoplasty was done Aug. 2, 1943. The bronchopleural fistula persisted and a second operation was done on Aug. 31, at which time the fistula closed.

The patient was transferred to the department of urology Sept. 11, 1943, because of a stone in the left kidney pelvis (Fig. 33, A). The stone was removed and a postoperative atelectasis developed on the right (Fig. 33, B). The atelectasis cleared promptly following aspiration (Fig. 33, C and D). The postoperative course was otherwise uneventful except for pyuria, which gradually subsided.

The patient was returned to the chest service Dec. 1, 1943, because of continued drainage from the chest. The fistula closed gradually and by Jan. 23, 1944, the drainage was slight. On Feb. 1, 1944, the general condition was excellent, the bronchopleural fistula had closed, and only a small superficial sinus tract remained.

Bronchography with lipiodol as a contrast medium is an important examination and no effort is spared to delineate all portions of the bronchial tree. The importance of complete filling of all branches is shown by the number of patients in whom there has been bronchiectasis in one of the lower lobes, but with involvement of other lobes as well. This is particularly true of the lingular branch of the bronchus of the left upper lobe. If bronchography is resorted to, a complete examination of all branches is essential.

All lipiodol instillations are done in the X-Ray Department by a member of the chest group. The injection is made through a flexible catheter passed into the upper part of the trachea. The filling of the bronchial tree is done under fluoroscopic guidance, making certain that all branches are satisfactorily outlined, the patient being placed in various positions to insure complete filling of all lobes. Figure 34 shows the bronchial tree as outlined by this method.

The bronchogram in a typical case of bronchiectasis is shown in Figure 35. The following is the history:

CASE 15: A 36-year-old sergeant gave a history of frequent chest colds since having measles in 1922 complicated by pneumonia. He was in bed for six months in 1927 because of a productive cough with night sweats. A similar episode occurred in 1937. Large amounts of purulent sputum had been raised for a period of five to six years before induction. The sputum was occasionally tinged with blood. Physical examination showed clubbing of the fingers. The breath sounds at the left base were impaired. The bronchogram revealed an extensive bronchiectasis of the left lower lobe with minimal bronchiectasis on the right. Sinus examination showed extensive mucous membrane thickening in the antra. The vital capacity was 3.7 liters, a 16 per cent deficiency. The hospital course was uneventful. The patient was discharged without operation.

Our interest in coccidioidomycosis has recently been stimulated by the arrival of an occasional patient with this disease from the southwestern states, where it exists in endemic form. Much credit is due to the men on our chest service for the prompt diagnosis of this condition. The chief roentgen findings have been notable, in

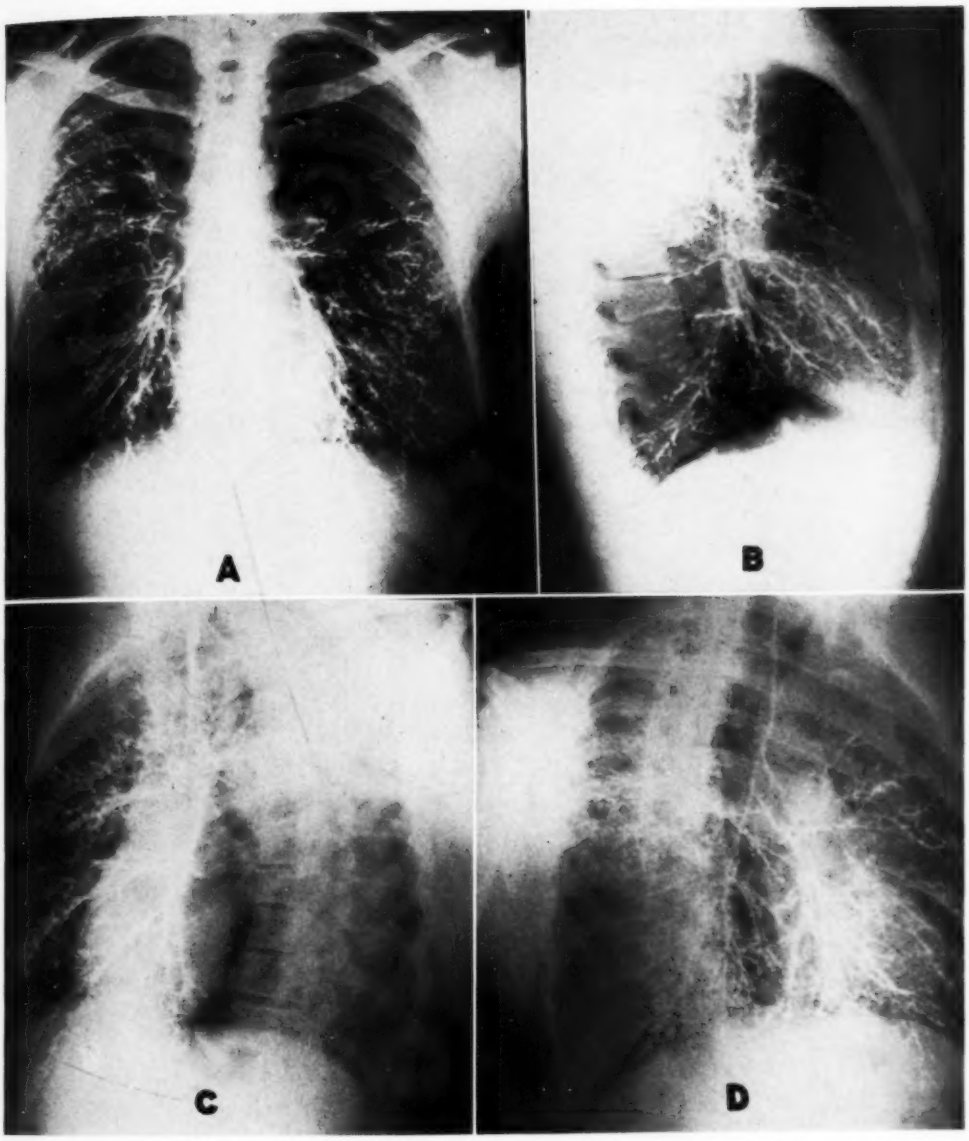


Fig. 34. Bronchography. A. Normal bronchogram, made in postero-anterior position, showing complete filling of all branches. B. Lateral projection made after filling the branches of the right bronchus, but before filling the branches on the left. A lateral view with both sides filled is of little value. C. Left postero-anterior oblique projection, showing structures on right before filling left side. D. Right postero-anterior oblique projection, both sides being filled. This shows particularly well all branches of the left bronchus.

These four films are the ones routinely used in bronchography. We usually obtain a postero-anterior view of the side first filled as well.

that they may be indistinguishable in appearance from those caused by tuberculous or non-tuberculous pulmonary infections. We have found it necessary to bear this diagnosis constantly in mind when dealing with any bizarre type of pulmonary lesion, whether it be apical or basal in distribution, and to inquire regarding the skin

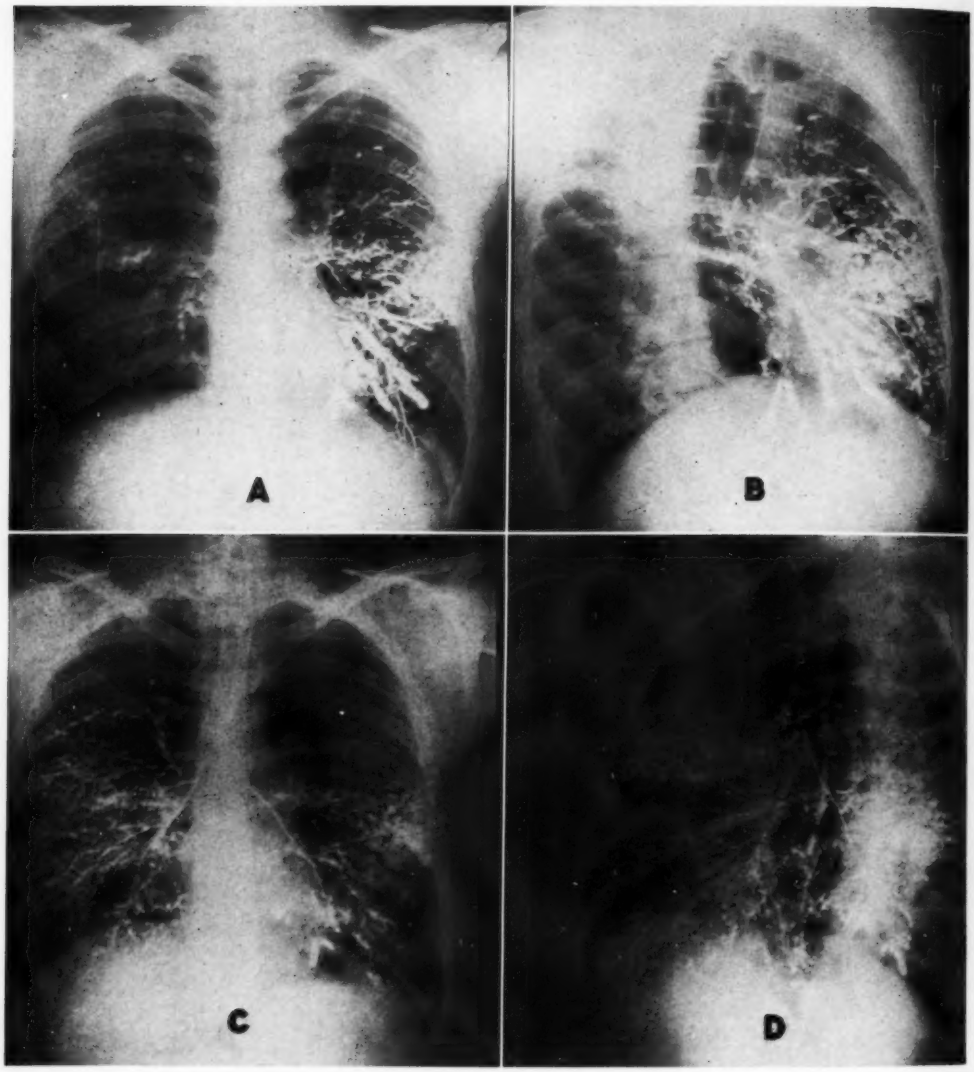


Fig. 35. Case 15: Bronchiectasis demonstrated by bronchography. A and B. Bronchograms in postero-anterior and right postero-anterior oblique projections, showing complete filling of all branches of the left bronchus. Extensive bronchiectasis of the left lower lobe is demonstrated. C and D. Complete visualization of all branches of the bronchus on the right shown in postero-anterior and left postero-anterior oblique projections. Minimal dilatation of some of the smaller branches of the bronchus of the right lower lobe is shown.

test, which in most instances becomes positive some time during the third week of the disease.

Semi-arid weather conditions in parts of California, New Mexico, Arizona, and Texas favor the growth of the pathogenic fungus which has been responsible for outbreaks in several Army camps. In areas where the disease is endemic, it has now become routine to do a coccidioidin skin test on all new recruits. A positive intracutaneous test along with certain clinical signs, including the not infrequent finding of erythema nodosum and a mild arthritis, establishes the diagnosis, and in certain instances the pathogenic organism,

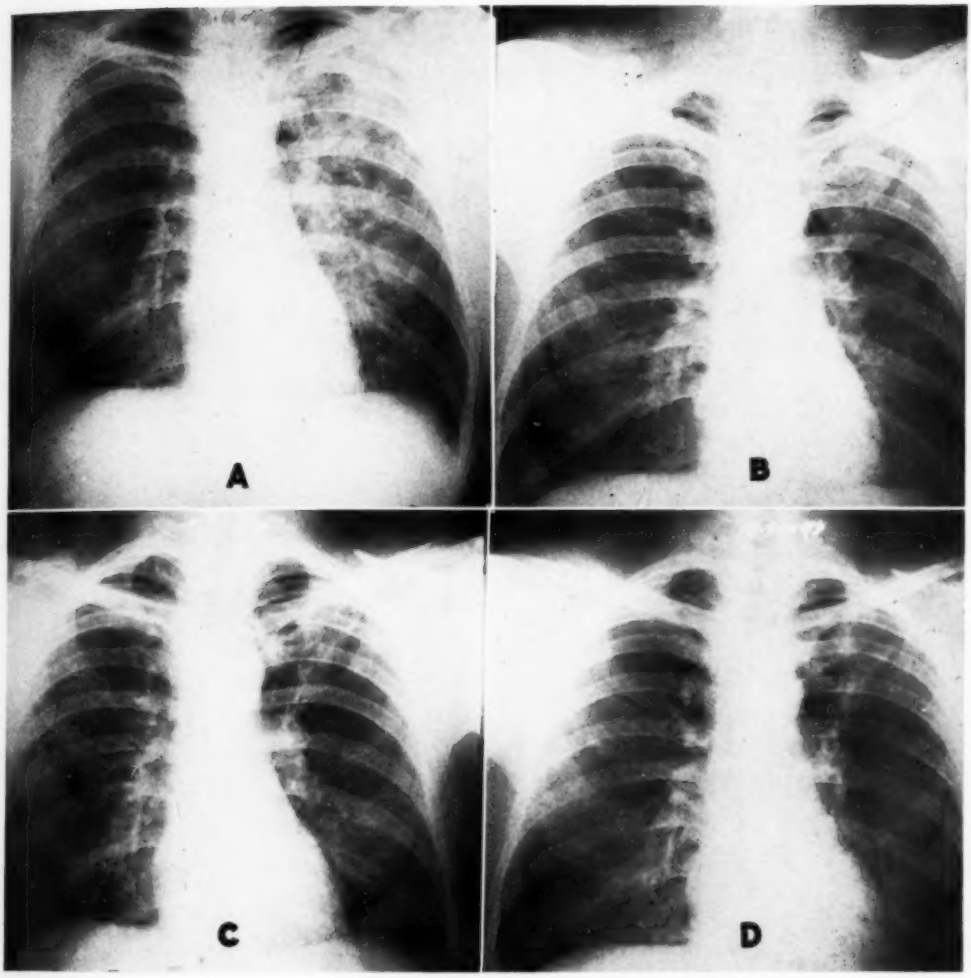


Fig. 36. Case 16: Pulmonary coccidioidomycosis. A. Appearance of chest Dec. 19, 1942: extensive lesions characteristic of coccidioidomycosis. B. Condition of chest five weeks later, showing marked clearing. A small residual area of involvement is still present in the left infraclavicular region. C. Condition of chest in September 1943, when the patient entered our hospital: small residual lesion still present in left infraclavicular area. D. Condition of chest one year after the onset of the disease. The patient was clinically well and the chest was almost clear. He was discharged to duty in January 1944.

*Coccidioides immitis*, can be recovered from the sputa and gastric washings.

The roentgenologist should bear in mind that there are two types of the disease. The first, which is most frequently encountered, is relatively benign and has been designated as a primary phase. In this stage one sees nodular areas of increased density or atypical, somewhat pneumonic-like consolidations in the lung fields, the latter being not dissimilar from those seen in so-called virus pneumonias. Thin-walled cavities may be present, which usually close spontaneously. The secondary, or granulomatous phase, although less frequent, is highly fatal and is characterized by mediastinal adenopathy, not unlike that occurring in Hodgkin's disease, and chronic fibrotic pulmonary changes with or without cavitation. Bone lesions, which are likely to occur during this phase, have a bizarre distribution and show a pred-

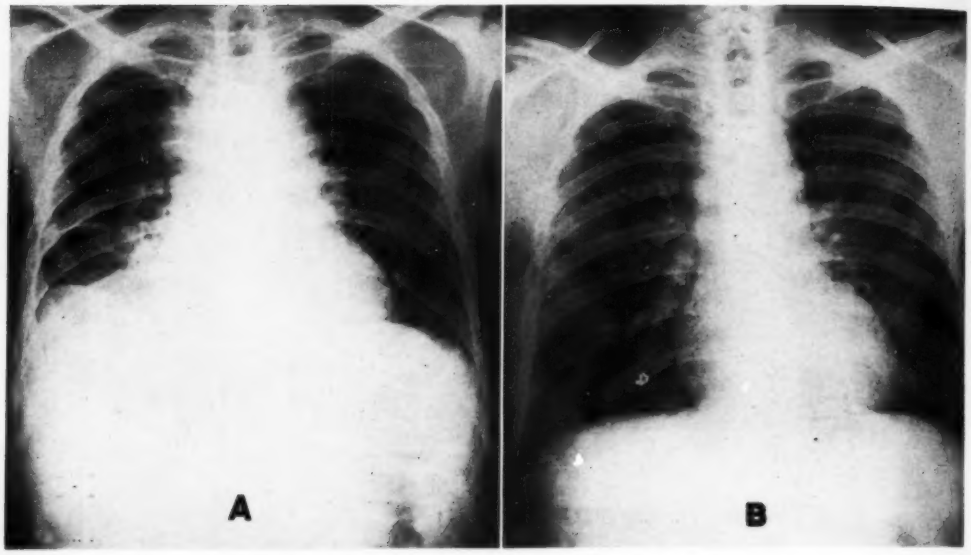


Fig. 37. Case 17: Mediastinal Hodgkin's disease. Chest before (A) and following (B) roentgen therapy.

ilection for pressure points, such as the malleoli, the acromion processes, the olecranon, etc. Miliary dissemination is not infrequently a terminal manifestation of the disease.

An illustrative case of pulmonary coccidioidomycosis is shown in Figure 36. The following is a history of this case.

CASE 16: A 34-year-old soldier was stationed in the Arizona desert. In November 1942, two months after being stationed there, he became acutely ill, with headache, cough, pain in the left side of the chest, mild fever, malaise, and night sweats. These symptoms persisted for the next three weeks, at the end of which time erythema nodosum developed. Physical examination revealed numerous coarse râles through the left chest. The blood sedimentation rate was 30 mm. for the first hour. Within the next few days the patient became relatively asymptomatic and afebrile. He was discharged Feb. 1, 1943, the sedimentation rate having dropped to 15 mm. for the first hour. He was again hospitalized in July 1943, because of recurrent pain in the left chest, and was transferred to Percy Jones General Hospital Sept. 7, 1943. He was afebrile at this time and the blood count and sedimentation rate were normal. Physical examination revealed nothing abnormal. In October 1942, two weeks before the beginning of the illness, the coccidioidin skin test was negative. The test was repeated at the time erythema nodosum developed, when it was found to be strongly positive. It was again repeated at this hospital, ten months later, and was still positive in 1:100 dilution. The tuberculin test at this hospital was also positive. Repeated studies of the sputa and gastric washings both for tubercle bacilli and *Coccidioides immitis* were negative. The patient returned to duty, apparently cured, Jan. 15, 1944.

Hodgkin's disease has been seen comparatively frequently, as one would expect in this age group. The response to radiation therapy, except in the acute form, has been satisfactory, at least temporarily.

A typical case of mediastinal Hodgkin's disease is shown before and after treatment in Figure 37. The history was as follows.

CASE 17: A 26-year-old private in the Air Force was admitted to Percy Jones General Hospital in August 1943. He gave a history of loss of weight and weakness extending over a period of two and one-half months. The symptoms appeared while he was on duty in North Africa. He experienced sharp mid-abdominal pain. In the Station Hospital he was found to have an irregular fever and a rapid sedimentation rate.

The patient was critically ill, with a tense, distended abdomen. X-ray examination showed a large mediastinal mass characteristic of Hodgkin's disease. Bilateral supraclavicular lymph nodes were present. Between Aug. 7 and Dec. 1, 1943, heavy radiation was given to the mediastinum and abdomen anteriorly and posteriorly. The patient responded promptly to treatment and was discharged to a Veterans' Facility for further care in

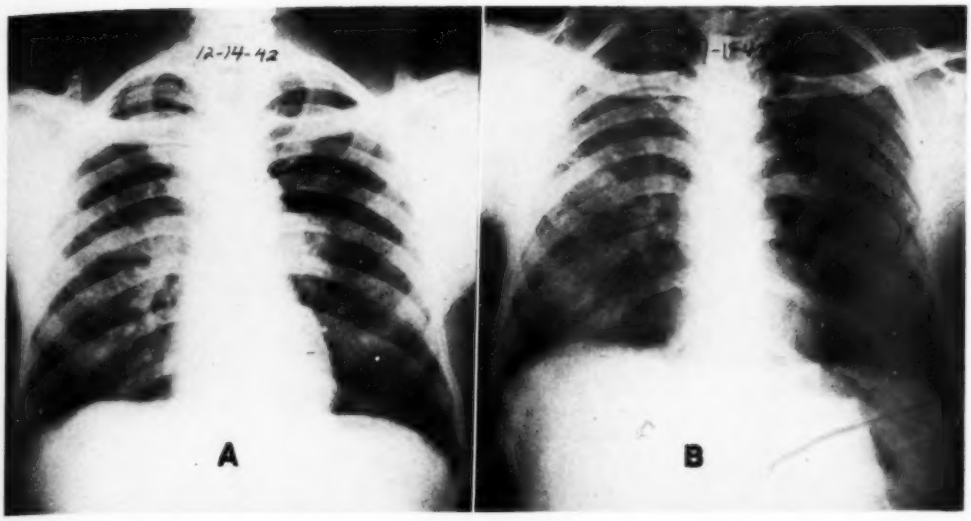


Fig. 38. Case 18: Typical case of Boeck's sarcoid. A. Condition of chest in December 1942, with marked enlargement of lymph nodes. B. Condition of chest in July 1943. The mediastinal nodes are still enlarged, there is reaction about the bronchi on the right, and the right lung field is definitely more dense than the left.

December 1943, at which time he seemed to be in excellent physical condition.

Several cases of Boeck's sarcoid have been encountered. One is shown in Figure 38.

CASE 18: A 31-year-old Negro sergeant first reported for sick call in June 1942, because of weakness and right upper quadrant distress. He reported four times on sick call between June and November. On Nov. 8 he had much bleeding from the gums and on one occasion there was a profuse spontaneous gingival hemorrhage at night. On Nov. 11 he fainted, due to hematuria, and was placed on the critical list. Multiple transfusions brought about apparent recovery by Dec. 5. Ten platelet counts showed a range between 20,000 and 124,000. On Nov. 11, x-ray examination showed enlargement of the hilar lymph nodes, and a presumptive diagnosis of lymphoblastoma was reached. Nine chest films made at intervals thereafter showed a steadily increasing change in both lung fields, indicating a progression of the disease. Eye consultation showed a bilateral hemorrhagic retinitis. Biopsy of axillary lymph nodes was unsatisfactory. Tuberculin skin tests were negative. The transfer diagnosis on admission to this hospital was purpura hemorrhagica, retinitis, and iridocyclitis. Our chest findings showed a mediastinal mass, increase in the truncal markings, and hypo-aeration of the right lung field. Biopsy of an enlarged cervical lymph node showed sarcoidosis with complete replacement of the node by a granuloma exhibiting no evidence of caseation. A diagnosis of Boeck's sarcoidosis was made. The

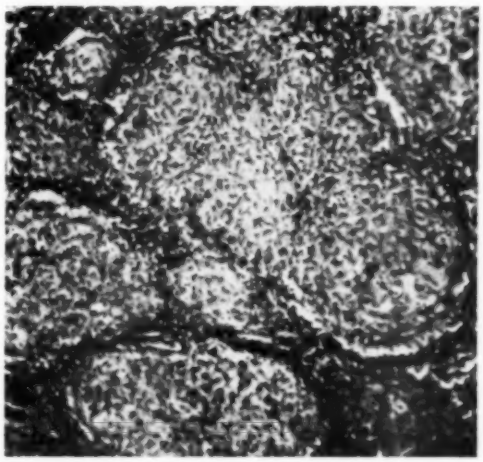

Fig. 39. Case 18: Boeck's sarcoid. Section showing typical formation of conglomerate tubercles composed of epithelioid cells with compression of intervening lymphoid structures. No evidence of caseation and no tubercle bacilli found on section.

course was that of progressive improvement with gain in weight. The only complaint was slight diminution of vision and a morning cough. The patient was discharged to his home in excellent health, although the lung fields were still definitely abnormal.

Three carcinomas of the lung seen have all been of unusual interest, representing

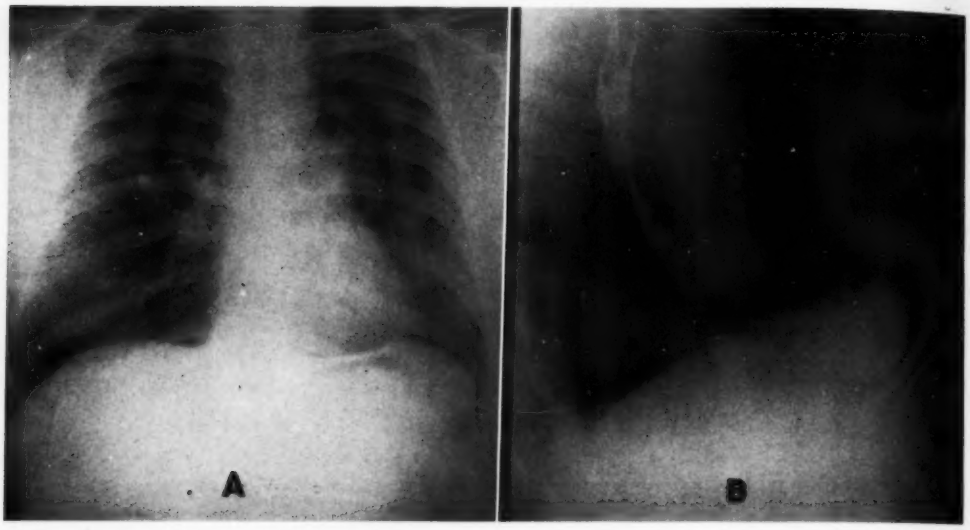


Fig. 40. Case 19: Carcinoma of lung. A. In this view the chest apparently is essentially normal. B. The esophagus is seen filled with contrast material. It appears to be flattened, twisted, and displaced somewhat posteriorly. The surrounding area is quite dense, suggesting the possibility of a new growth in this region. A primary bronchiogenic carcinoma was later demonstrated.

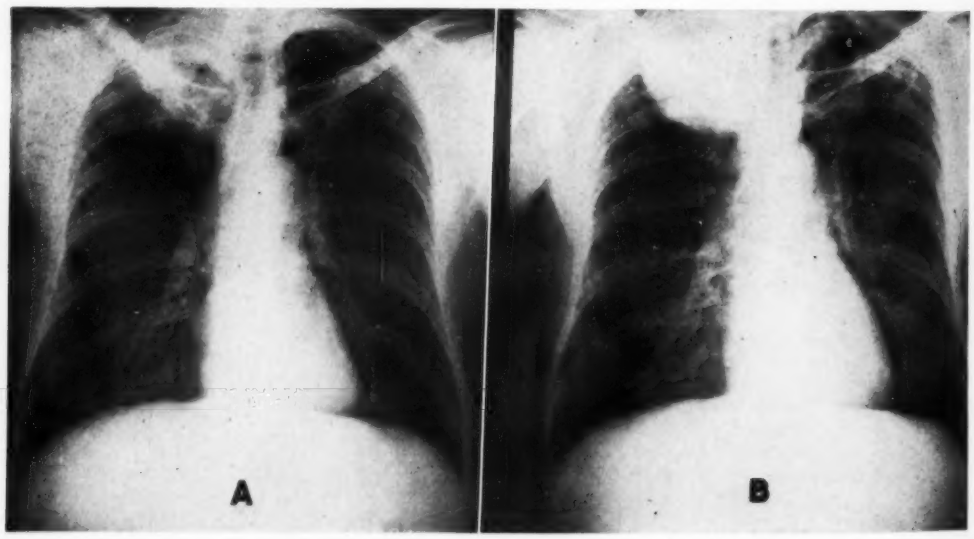


Fig. 41. Case 20: Carcinoma of lung. A. Condition of chest in August 1943. There is a cavity in the right upper lobe with a dense shadow above it, later shown to be due to a carcinoma. B. Roentgenogram made two months later. The tumor has increased greatly in size and there is now infiltration in the left apex as well. The latter may well be due to spread of a tuberculous infection, for tubercle bacilli were demonstrated repeatedly in the sputum.

distinct types. The histories and findings follow.

CASE 19: A 45-year-old sergeant with twenty-seven years of active military service was hospitalized because of hoarseness, dyspnea, and wheezing, of six months' duration. The left vocal cord was paralyzed. The patient was transferred to this hospital in August 1943, with a diagnosis of chronic bronchitis. Our x-ray examination showed the

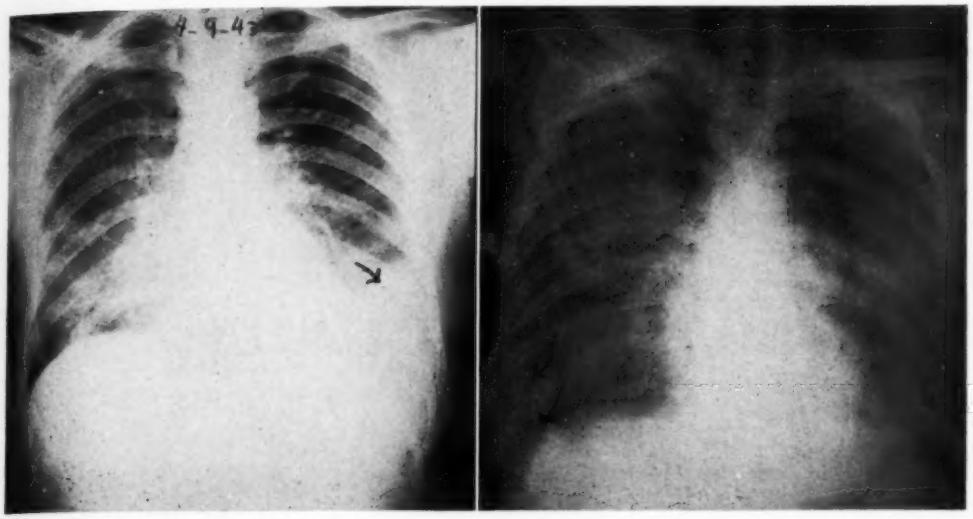

Fig. 42. Case 21: Carcinoma of lung. Condition of chest April 9, 1943, and June 10, 1943. There is diffuse miliary infiltration throughout the lung fields with a bilateral pleural effusion. The infiltration was shown at autopsy to be due to a diffuse carcinomatosis.

esophagus to be slightly displaced and rotated, as shown in Figure 40. There was a suggestion of an area of increased density posterior to the arch of the aorta. The sedimentation rate was slightly increased. Bronchoscopy showed evidence of extrinsic pressure indenting the bronchus of the left upper lobe, but no intrinsic tumor was found. It was our impression that a tumor in the mediastinal area was responsible for the deformity of the esophagus shown. In October, enlarged supraclavicular nodes were observed, and a biopsy revealed a squamous-cell carcinoma.

The patient was given deep radiation therapy over the upper mediastinum and upper part of the left side of the chest, the total dosage being 2,000 r measured in air to each of two mediastinal ports and 1,800 r to each of two supraclavicular ports. The enlarged supraclavicular nodes regressed promptly and there was definite improvement in the patient's breathing. He did fairly well until March 1944, when he suddenly had a massive pulmonary hemorrhage and died. At autopsy there was found to be infarction of the left upper lobe due to thrombosis of the pulmonary vein by invading tumor tissue. As a result, a varix had formed, which had ruptured into the bronchus and caused death.

In this case the roentgen findings were minimal but stimulated a careful search for a pulmonary new growth. Had the esophagus not been examined with barium and the persistent deformity not been discovered, the patient might have been dismissed as showing no evidence of disease.

CASE 20: A 43-year-old corporal was admitted to Percy Jones General Hospital June 24, 1943. His induction films had been considered normal. In February 1943, he suffered from what was diagnosed as pneumonia involving the right upper lobe. An x-ray examination at that time revealed a cavity in the right apex, which was considered to be of tuberculous origin. The patient was asymptomatic until May 1, 1943, when a chronic non-productive cough developed. The sputum was blood-tinged. Pain in the right shoulder and right arm then appeared. Examination showed a clubbing of the fingers, which was said to have been present since 1935. The teeth were examined and multiple abscesses were found. Extraction of the teeth was followed by relief of the pain in the shoulder and arm. The patient gave a further history of having worked in a tuberculosis sanatorium for five months prior to his induction into the Army.

On admission to our hospital in June 1943, the white blood cell count was 25,000. Tubercle bacilli were found in the sputum, together with fusiform spirochetes and yeast. Roentgen examination revealed a cavity in the right apex, as shown in Figure 41. It was surrounded by a dense homogeneous shadow, the widest portion of which extended from the cavity into the apex, forming a peculiar cap-like mass above the cavity. For this reason our conclusions were that we were probably dealing with a cavity in a malignant tumor rather than a tuberculous cavity. The lesion increased rapidly in size during the patient's stay in our hospital. An exploratory thoracotomy was done, at which time an inoperable carcinoma of the right upper lobe was found. Following exploration, a culture of the spu-

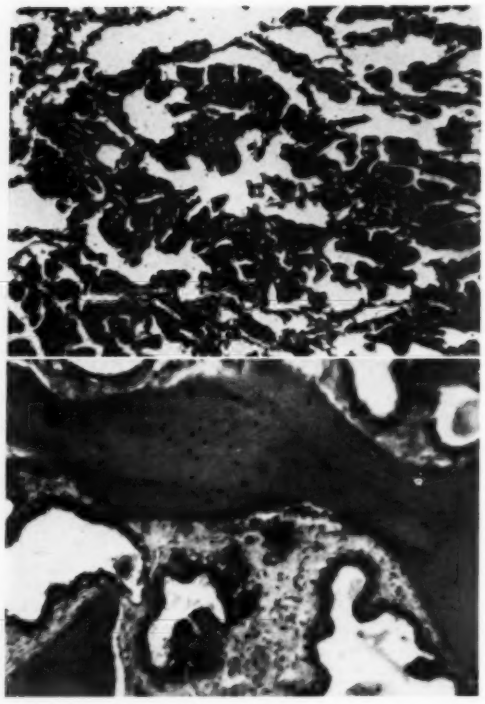

Fig. 43. Case 21: Multicentric carcinomatosis of the lung. The section above reveals papillary adenocarcinoma growing in branching fronds and finger-like projections into the air spaces of the alveoli. That below shows metastatic growth in a lumbar vertebral body. There has been complete replacement of the marrow by tumor cells and fibrous stroma. The bony elements apparently are still intact.

tum again revealed tubercle bacilli. The biopsy showed an undifferentiated squamous-cell carcinoma. This had evidently developed in the region of an old tuberculous infection.

CASE 21: A 41-year-old private was admitted to a station hospital in June 1943, because of cough, fever, and pain in the inguinal regions, which was relieved by heat and massage. Roentgenograms made on April 6 and 18, 1943, showed miliary densities in both lung fields and a massive pleural effusion on the right. The following month a large amount of fluid was observed on the left, shown by thoracentesis to be serosanguineous. On admission to this hospital in June, the main complaints were constipation and right upper quadrant pain. The liver was enlarged. The appearance of the chest is shown in Figure 42.

Physical examination showed cyanosis of the nail beds. The mediastinum was deviated to the left by fluid in the right pleural space, and there was pitting edema of the legs. Many collateral veins were present on the thighs and abdomen. During the first two weeks in this hospital purulent blood-tinged sputum was raised. The patient suffered from recurrent pleuritic pain, first on one side and then the other. On July 13, 1943, he complained of coldness and numbness of the left hand. On July 16 he became aphasic and showed right facial weakness. Death occurred July 27, 1943.

Necropsy revealed diffuse carcinomatosis of the lungs, apparently primary in the right main stem bronchus. There was infarction of the left lower lobe, with necrosis, suppuration, and encapsulated empyema. Thrombosis of the common iliac and femoral veins and distal portion of the inferior vena cava was found. Thrombo-endocarditis of the mitral and tricuspid valves was present, with embolism of the splenic artery, left renal artery, left radial artery, the cerebral arteries, and anterior descending branch of the left coronary artery. There were small metastatic lesions in the liver, adrenals, kidney, and pancreas.

This thrombophilic diathesis with cancer has been known for a long time. It is thought by some to be the result of cancer toxins acting on the capillary endothelium or on the mast cells of Ehrlich, which form heparin.

We have seen one case of blastomycosis, which is of unusual diagnostic interest. The history and findings are as follows:

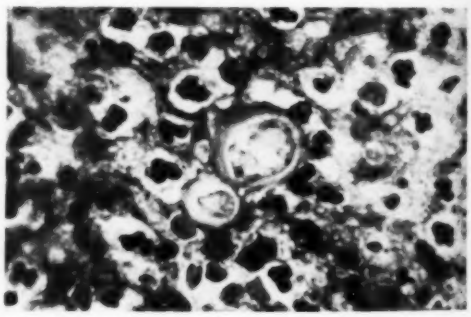

Fig. 44. Case 22: Blastomycotic osteomyelitis showing budding yeast cell within purulent exudate.

CASE 22: A 31-year-old private, first class, with six months' service gave a history of pain on breathing, associated with a dry, hacking cough, in May 1943. Consolidation was demonstrated in the lung fields at this time. The patient was not acutely ill; the temperature was normal, and the white blood cell count was 13,000. A diagnosis of atypical pneumonia was made. The patient began to lose weight, the cough became productive, and the temperature occasionally rose to 99.6. The sputum was blood-streaked on three occasions, but was repeat-

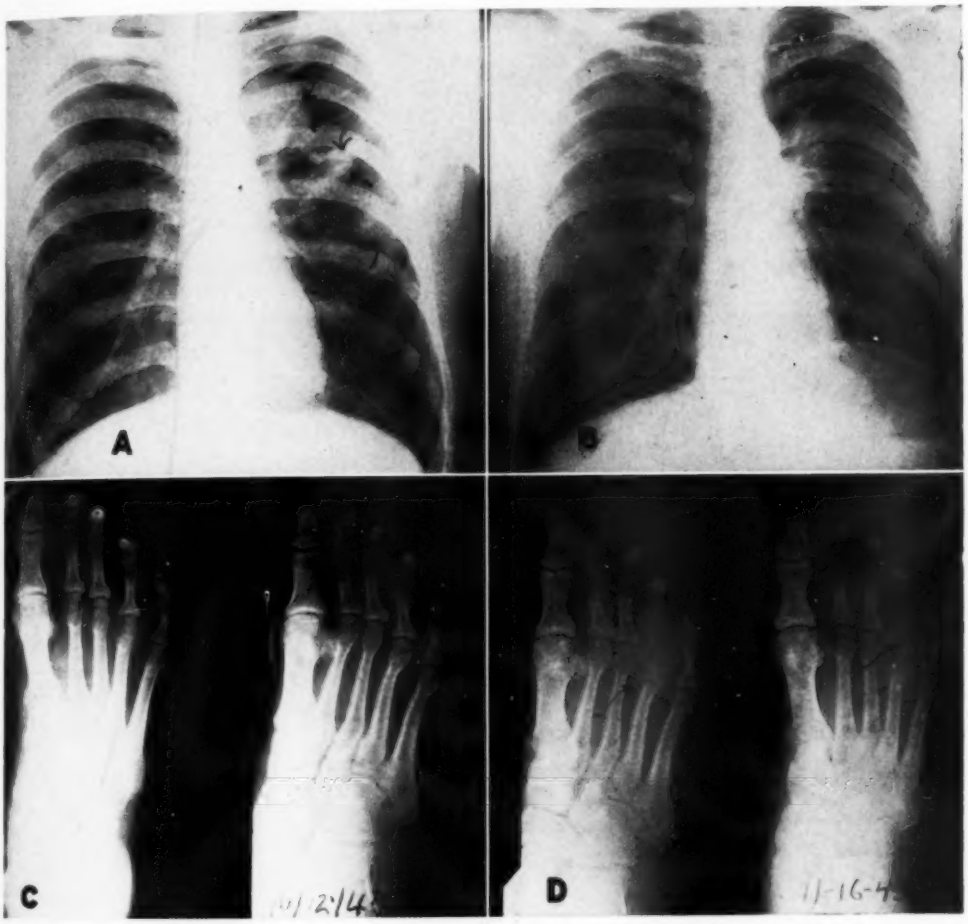


Fig. 45. Case 22: Blastomycosis. A. Mass lesion lateral to the arch of the aorta in a patient later shown to have a blastomycosis in the right foot. B. Condition of the chest seven months later, when the patient was apparently clinically well. C. Two views of the right foot when the patient exhibited swelling and tenderness in the region of the distal end of the fourth metatarsal. No abnormalities were demonstrated. D. Condition of foot approximately five weeks later. At this time there was extensive destruction of the proximal phalanx of the fourth toe and the distal end of the fourth metatarsal. There was some periosteal reaction along the medial margin of the distal half of the fourth metatarsal. Blastomyces were found in the material removed at operation.

edly negative for tubercle bacilli. The blood sedimentation rate ranged between 55 and 75 mm. during the first hour.

When the patient was first seen here, an irregular mass was found just to the left of the mid-line in the region of the arch of the aorta. It did not seem characteristic of a primary carcinoma nor was it characteristic of a tuberculous infection. A bronchoscopy was done and small ulcerations were found in the left main bronchus that were considered characteristic of an endobronchial tuberculous infection. Acid-fast organisms were found in one gastric washing. The ulcers were cauterized, and progressive healing of the mucosa took place.

On Oct. 1 the patient first began to complain of discomfort in the region of the base of his fourth toe, and swelling and redness were noted in this area. The temperature was 99.2°. The white blood cell count was normal. X-ray examination of the metatarsal phalangeal area was negative. On October 15 purulent material was aspirated from the area of swelling about the distal end of the fourth metatarsal, but the cultures were sterile. X-ray examination, Nov. 16, showed extensive bone destruction involving the proximal phalanx of the fourth toe and the adjacent part of the distal end of the fourth metatarsal. Some periosteal thickening was present. Other parts of the skeletal system

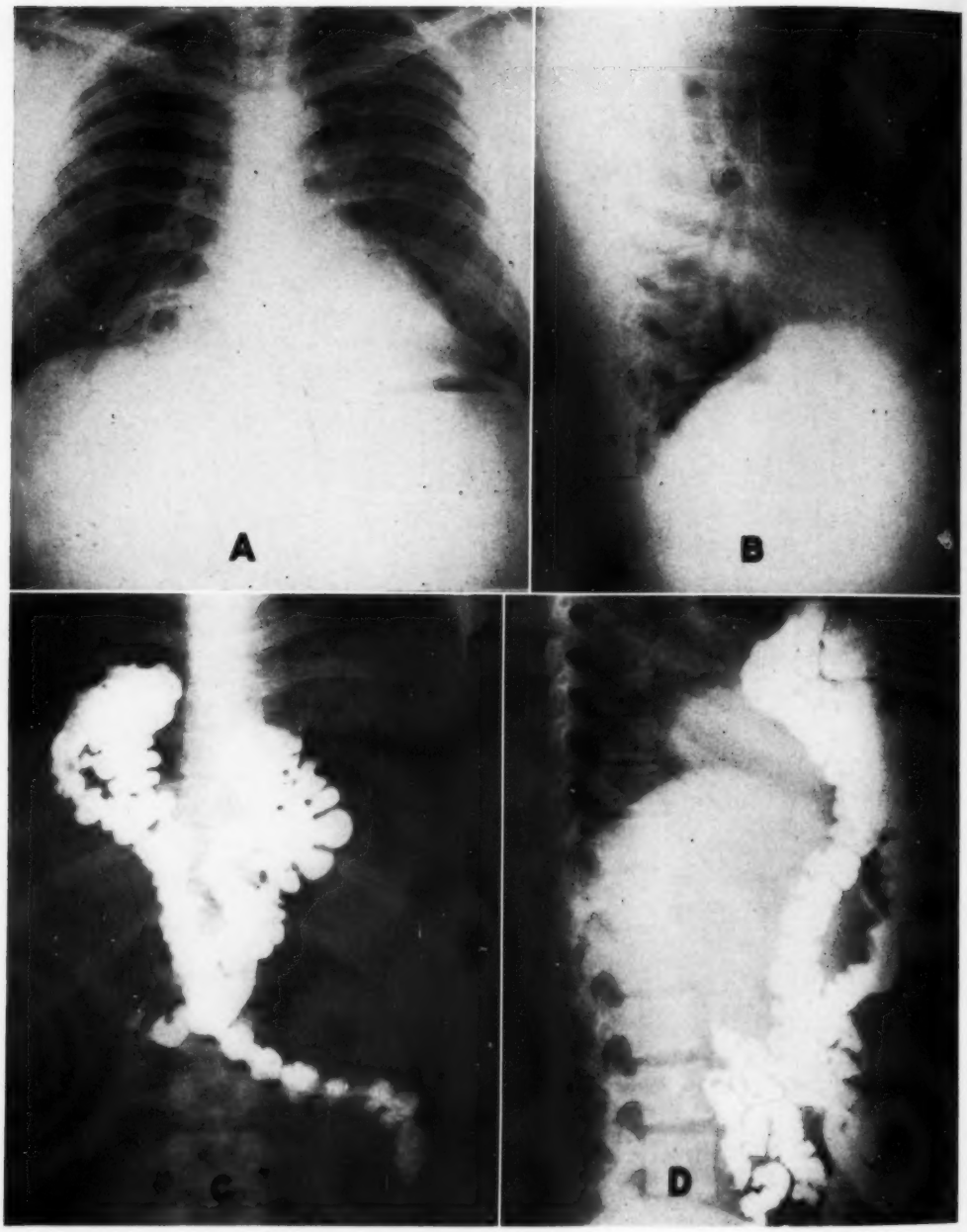


Fig. 46. Case 23: Diaphragmatic hernia. Films of the chest (A and B) showed a sharply circumscribed shadow lateral and anterior to the right cardiac border. It was thought that this shadow indicated the presence of a diaphragmatic hernia, and this was shown to be the case during the examination of the gastro-intestinal tract (C and D). The stomach and small bowel were below the diaphragm, but portions of both the cecum and what would ordinarily be the splenic flexure and colon were in the hernial sac which lay in the anterior part of the thorax.

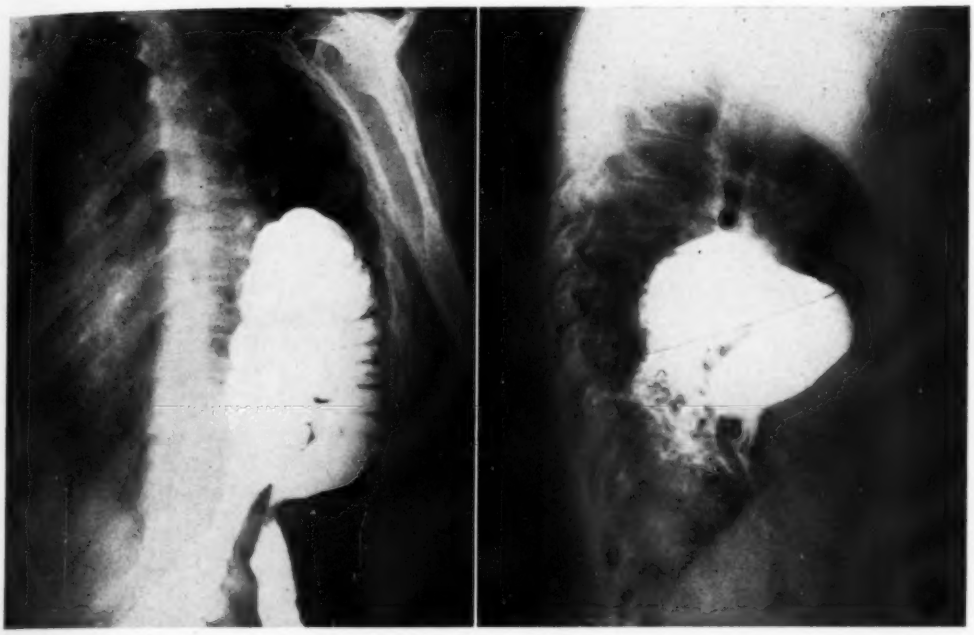

Fig. 47. Case 24: Gastro-intestinal examination showed all of the stomach and a large part of the left half of the colon to be in the left side of the thorax. There was still a question whether the displacement of the stomach and colon might be due to an eventration rather than a diaphragmatic hernia and for this reason a pneumoperitoneum was done. This resulted in a partial pneumothorax, proving the presence of a communication between the pleural and peritoneal spaces.

were examined and found to be normal. On Dec. 6 there was further evidence of destruction of the fourth metatarsal head of the adjacent portion of the fourth phalanx. A resection of the involved bone was done and cultures of the material removed showed blastomyces. Prior to this the patient had been placed on sulfadiazine. It was planned to desensitize him to the organism found, but he improved so rapidly that this was not done. At the present time the chest is essentially normal except for slight fibrosis in the left root region. There is no pain in the foot, and there has been no further evidence of destruction. From the clinical point of view the patient appears to be well. It seemed evident that the lesions in the chest and foot were of a similar nature. The lesion in the chest before and after treatment and the lesions in the foot are shown in Figure 45.

### THE GASTRO-INTESTINAL TRACT

Relatively few abnormalities of the esophagus have been found. Among those seen have been a few diverticula, two peptic ulcers, and a very few cases of cardiospasm. There have been no malignant tumors. Esophagoscopy has been performed in all cases where suspicious changes have been observed and has been a decided aid in diagnosis, particularly in the ulcers.

CASE 23: A large hernia through the anterior portion of the diaphragm is shown in Figure 46. A 19-year-old sergeant was transferred to this hospital because of a two-year history of cough with expectoration. There was slight dyspnea on exertion. Examination showed a hernia through the anterior portion of the diaphragm. Quite a large portion of the colon was in the sac of the hernia. At operation the hernial sac was found to consist of a single chamber, but the round ligament of the liver was invaginated, partially dividing it into two compartments.

We saw one case in which the differential diagnosis was of interest, being between an eventration and a diaphragmatic hernia (Fig. 47). The history and findings follow:

CASE 24: A 26-year-old staff sergeant was transferred to this hospital with a history of having been injured when sixteen years of age by a truck turning over. A dead horse which was in the truck fell on him, causing considerable trauma of the chest and abdomen. He suffered from pain and tenderness

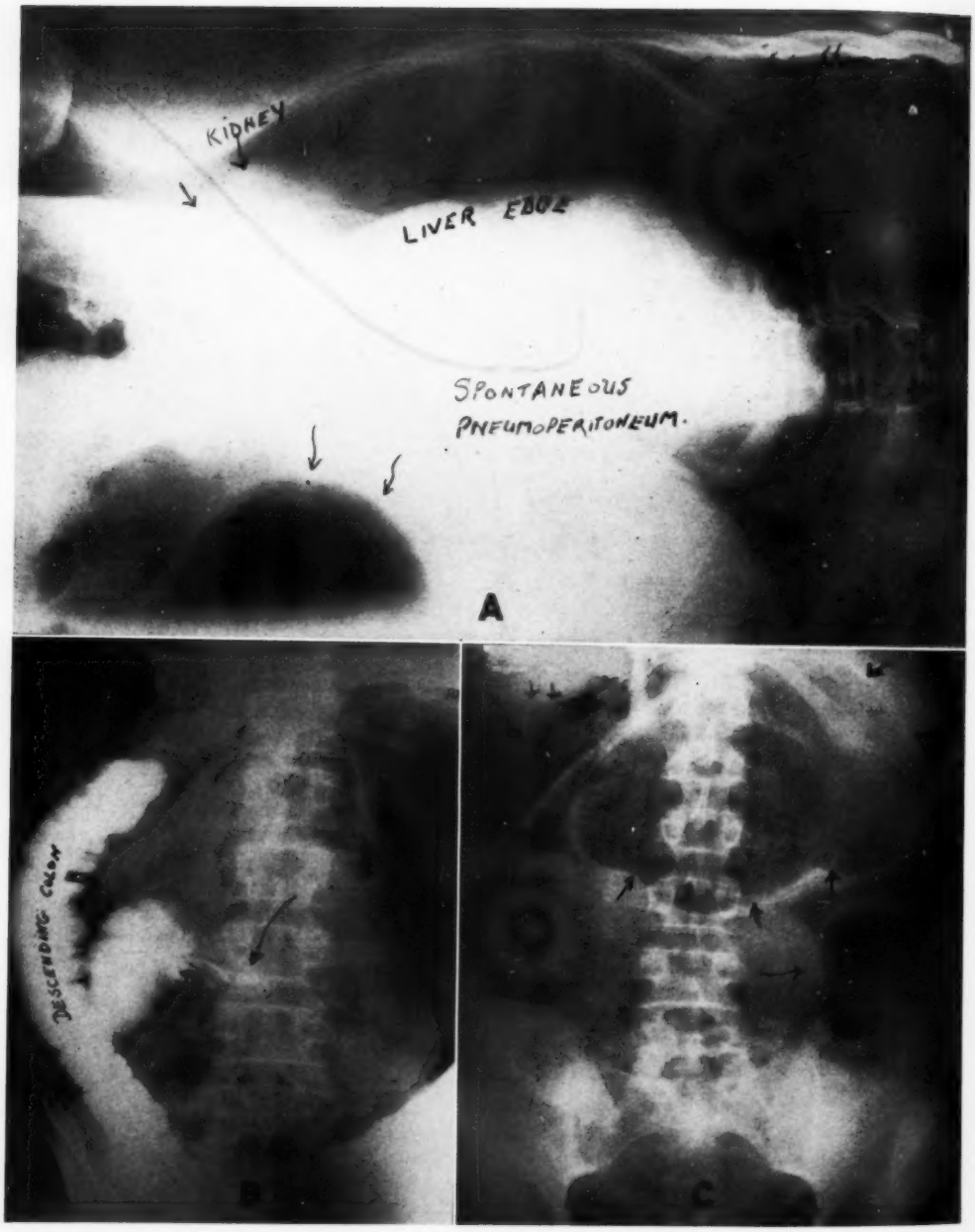


Fig. 48. Case 25: A. Lateral decubitus film showing the presence of extensive spontaneous pneumoperitoneum together with distended loops of bowel showing fluid levels. B. Partial filling of the colon with contrast material done elsewhere. The descending colon is on the right. The transverse portion is obstructed. The appearance in the area of obstruction suggests pressure from without rather than obstruction due to an intrinsic lesion. The large gas shadow in the left side of the abdomen was later shown to be due to a distended cecum lying in a hernial sac behind the lesser peritoneal cavity, several perforations of the cecum being present. C. Condition of the abdomen at the time the patient entered our hospital. a. Gas free in peritoneal space. b. Gallbladder.

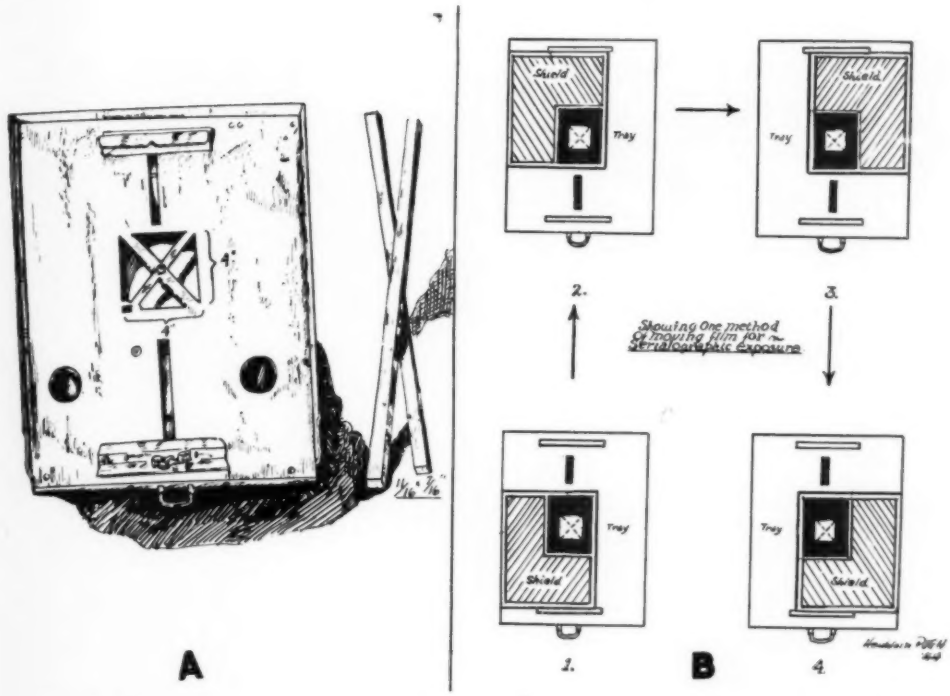


Fig. 49. A. Drawing showing the opening cut in the tray of the Bucky diaphragm in order to permit fluoroscopic centering of the part being examined. The small sticks at the right are required in order to insure accurate centering of a 10 × 12-in. cassette. B. Showing use of a lead shield and method of shifting the cassette in order that four serial exposures, each 5 × 6 in., can be secured.

and was in bed for four or five days. He was then well for about six years, after which he began to suffer from attacks of abdominal pain, without nausea or vomiting. On three occasions a diagnosis of appendicitis was made, but the patient was not operated upon. The attacks became less frequent and he was quite well until eighteen months after entering the Army, when he again began to suffer from abdominal pain. He was working as an airplane mechanic and the pain was most severe when he bent over in a cramped space. On one occasion it was so intense that he fainted. A lesion was found in the left side of the chest by x-ray and the patient was evacuated from overseas and sent to our hospital. The greater part of the stomach and a portion of the left side of the colon were seen to be well above the usual level of the left side of the diaphragm. It was impossible to be certain whether we were dealing with an eventration or a diaphragmatic hernia, and pneumoperitoneum (Fig. 47) was done. The gas passed from the abdomen into the thorax, causing a partial pneumothorax and proving that there was a defect in the left side of the diaphragm. It is a question whether this defect was developmental in origin or the result of trauma. The history would suggest a traumatic origin.

One spontaneous pneumoperitoneum was encountered due to rupture of the cecum secondary to an internal hernia.

CASE 25: A 23-year-old technician, fifth grade, was transferred to this hospital with a history of abdominal pain and swelling of the right testicle first manifest two weeks prior to admission. The white blood cell count was moderately elevated and there had been some nausea and vomiting immediately prior to admission. Upon physical examination the abdomen was found to be moderately distended and there was a palpable mass in the right side. Films showed an extensive pneumoperitoneum, together with a circumscribed gas shadow in the upper half of the abdomen which seemed indicative of gas confined in a closed space, possibly in the lesser peritoneal cavity. The above findings are shown in Figure 48.

It was obvious that there had been a perforation of some part of the gastro-intestinal tract. The patient was operated upon immediately. The cecum was found to be tremendously dilated and perforated. It lay in a hernial sac behind the lesser peritoneal cavity, which accounted for the circumscribed area of decreased density in the upper abdomen

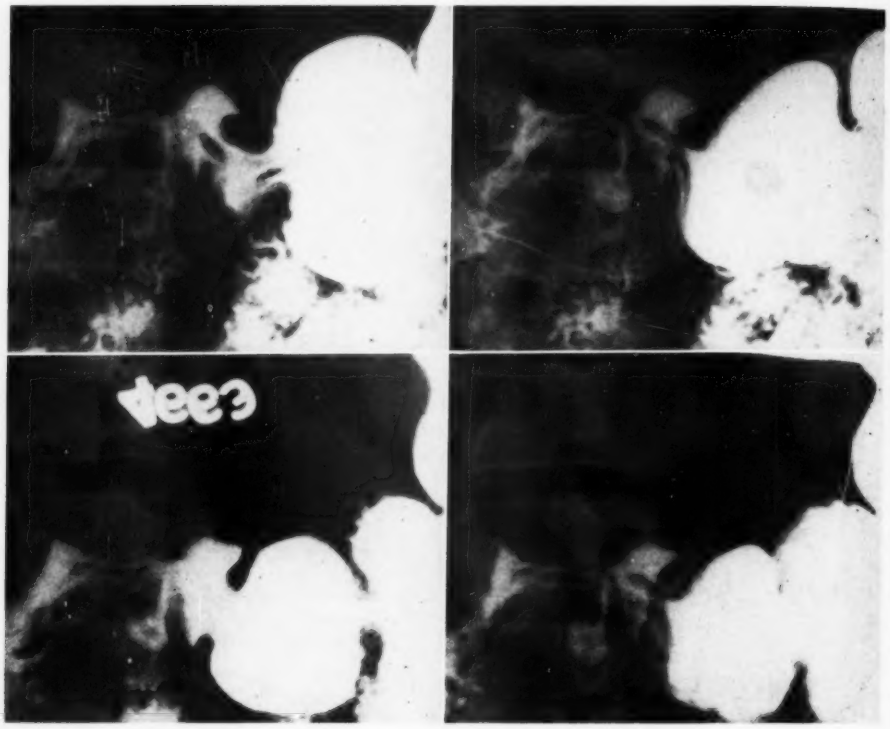

Fig. 50. Four serial exposures showing the typical deformity of a duodenal ulcer and illustrating the value of serial exposures in demonstrating flexibility of the walls of the stomach.

shown in our films. A band of adhesions extended across and partially obstructed the small bowel. The cecum, part of the ascending colon, and the terminal six inches of the ileum were resected, and the terminal end of the remaining portion of the ileum was anastomosed to the proximal end of the remaining portion of the colon. The postoperative course was stormy, but the patient made a satisfactory recovery.

Peptic ulcer is a frequent and serious cause of disability in the Armed Services. In a little more than one year we have seen 181 duodenal ulcers and 6 gastric ulcers that from their course were apparently benign, the gastric ulcers accounting for but 3.3 per cent of the entire series. Most of our patients have had an ulcer history prior to induction. Many were asymptomatic at the time of entrance on active duty but symptoms subsequently developed during the training period or under battle conditions. Duodenal ulceration is not compatible with active military service except in rare instances where the diet and activity can be carefully controlled.

In examinations of the stomach and duodenum we consider an adequate number of films to be of decided aid in diagnosis, using compression over the part under suspicion when indicated and serial exposures routinely. The serial films are secured by means of a special opening in the Bucky diaphragm tray and a lead L-shaped protection shield, shown in Figure 49. This apparatus was arranged by one of us (G. W. H.) and permits fluoroscopic centering and the making of four exposures on each 10 × 12-inch film. Such serial exposures are of great value, providing a permanent record showing whether or not the part under observation is flexible, and, if a defect is present, whether or not it can repeatedly be demonstrated. These exposures are supplemented by others showing the entire stomach in various projec-

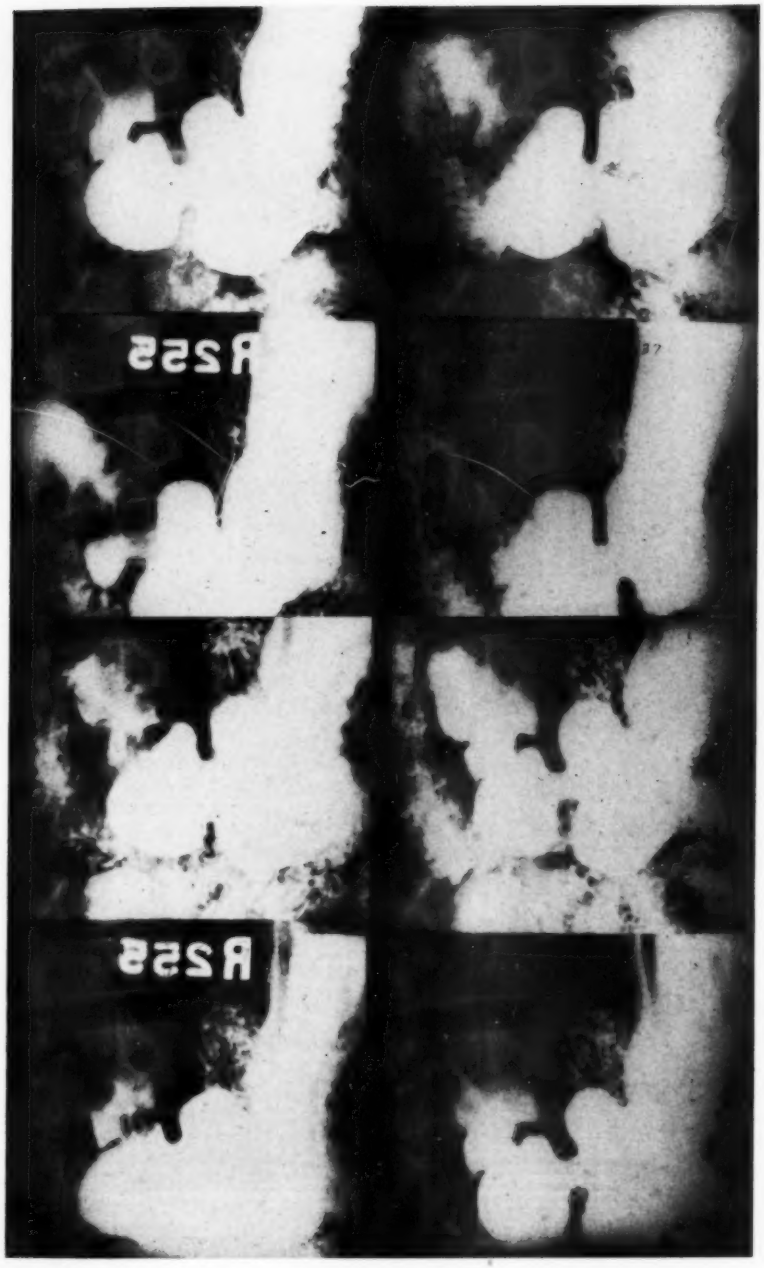

Fig. 51. Eight serial exposures showing varying degrees of filling of the duodenal cap, demonstrating the characteristic deformity of an ulcer, particularly when the cap is almost empty. In our work eight exposures of this type are made in the average case.

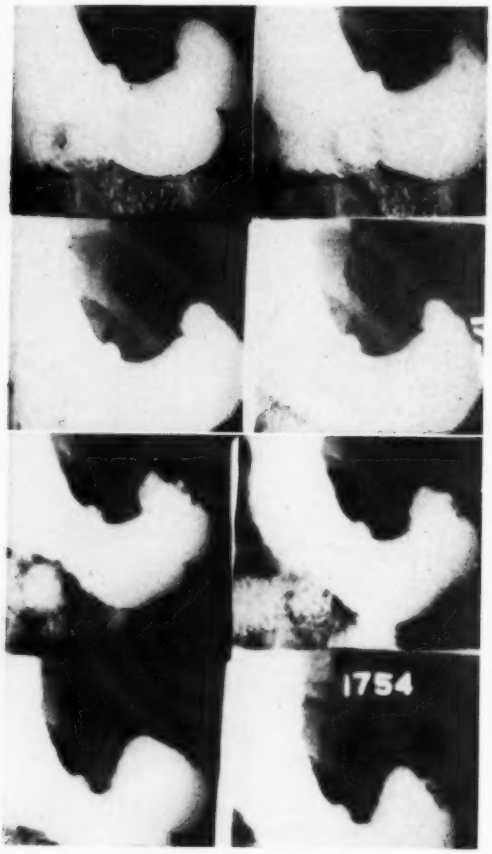


Fig. 52. Case 26: Diffuse carcinomatosis of the stomach. Four serial exposures of the stomach done at each of two examinations with an interval of six weeks. The ulcer is in the anterior wall of the stomach just proximal to the incisura angularis. It will be noted that the posterior wall of the stomach is flexible, but that no evidence of peristaltic waves can be seen in the anterior wall. The ulcer showed no improvement under strict medical management, and operation revealed a very diffuse submucosal carcinomatosis, the only abnormality in the mucosa being at the point of ulceration.

tions. Serial films made by the above method showing typical duodenal ulcers are seen in Figures 50 and 51.

Gastroscopy is available in this hospital and its use is encouraged by the staff of the X-Ray Department. It is an excellent check on the correctness of our observations. We have not found it possible to diagnose gastritis, either erosive or of other types, with any degree of accuracy, although this diagnosis can be made by

Fig. 53. Case 26: Diffusely infiltrative carcinoma of the stomach. Section showing infiltration between muscle fibers.

gastroscopy. Thus far no ulcers have been demonstrated by gastroscopy that had not already been detected by roentgen examination, although it is well recognized that ulcers may at times be gastroscopically demonstrated when they have not been revealed by the roentgen ray. The converse is also true.

The following case histories and findings are of interest:

CASE 26: A 23-year-old technician, fifth grade, was transferred to our hospital from the South Pacific with a history of having been well until March 1943, when he began to suffer from epigastric distress which was burning in character and was constant. Some relief resulted from hospitalization and intensive ulcer therapy. An x-ray examination while the patient was still in the South Pacific area showed a small circumscribed ulcer in the anterior wall of the stomach just off the lesser curvature, slightly above the incisura angularis. This ulcer was again demonstrated in our hospital and is shown in Figure 52. The gastric acidity was normal, the hemoglobin 106 per cent, and the white cell count was normal. Gastroscopy was done on three occasions, and a circumscribed ulcer was seen in the anterior wall of the stomach in the area described above. There was no abnormality of the surrounding mucosa, and in all other parts of the stomach the mucosa was normal. Rigid ulcer therapy was instituted, without any appreciable improvement, and after three weeks a gastric resection was done. Examination of the excised portion of the stomach showed diffuse carcinomatous infiltration beneath the mucosa throughout. The mucosa was normal except for an area of ulceration. The patient died two days after resection, due to pneumococcus septicemia.

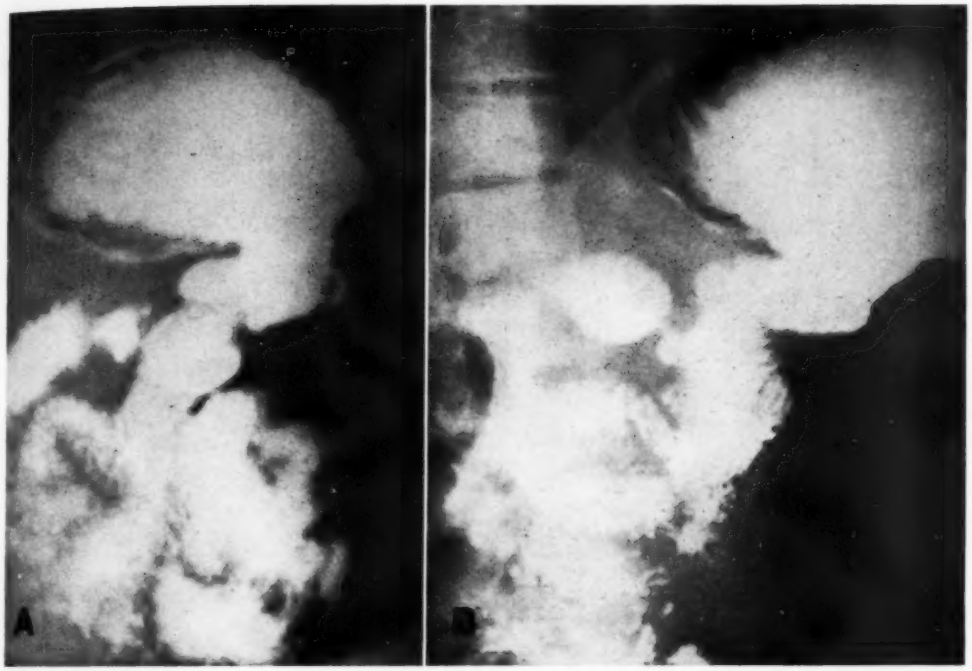

Fig. 54. Case 27: Carcinoma of the stomach. Films made at two examinations both demonstrate a constant deformity of the greater curvature side of the middle third of the stomach. That reproduced in A shows definite evidence of ulceration, which was demonstrated at gastroscopy and at operation.

CASE 27: A 24-year-old technician, fifth grade, was transferred to this hospital with a diagnosis of carcinoma of the stomach. He was well until the summer of 1943, when he began to experience weakness and found that he became fatigued easily. In September he noticed a dull girdle-like pain when he stooped over. In October the stools were tarry. X-ray examination at the station hospital showed an ulcerating lesion of the greater curvature of the stomach considered to be malignant in nature. Our x-ray findings were the same as those of the station hospital. The films made at the two examinations are shown in Figure 54. The gastroscopic examination showed a fungating mass with an ulcerated center. On Jan. 18, 1944, a subtotal gastric resection was done and an anaplastic infiltrating carcinoma Grade III was found. Some involvement of the regional lymph nodes had occurred.

Small bowel studies are done in all cases where such an examination seems indicated, particularly in patients suffering from gastro-intestinal symptoms without demonstrable cause in the colon or upper gastro-intestinal tract and in those with unexplained diarrhea or periumbilical pain. We have seen a number of patients with serious disturbances in the physiology of the small bowel. Some were obviously those of a deficiency state. An illustrative case is as follows:

CASE 28: A 22-year-old private, first class, was inducted in November 1940. He was well until September 1941, when in the European theater he was hospitalized because of nausea and vomiting. He was discharged after a period of one week but began to lose weight. By October 1942 he had lost approximately 50 pounds. He felt weak and was unable to do his work. In April 1943, he was hospitalized because of an intermittent diarrhea and was then returned to this country and sent to our hospital. The physical examination here was largely negative except for severe emaciation. The blood pressure was 90/70. There was a flat oral glucose tolerance curve and an excessive amount of fat was present in the stools. An x-ray examination showed a very considerable disturbance in the physiology of the small intestine. The walls seemed to lack flexibility and the bowel was tubular in appearance. Numerous areas of decreased density characteristic of polypoid changes in the mucosa were present along the margins of the bowel. Our findings are shown in Figure 56. A blood examination showed nothing that was definitely abnormal

Fig. 55. Case 27: Drawing made during gastroscopy, showing a typical carcinoma with a central area of ulceration corresponding to the changes demonstrated by x-ray.

except that the serum calcium was low. The patient was treated conservatively with a high-vitamin diet, large doses of liver extract, and rest. During a period of four months' observation here he showed marked improvement and gained 25 pounds in weight. The fat content of the stool became normal and our x-ray examination showed some improvement in the appearance of the small intestine. The patient was discharged to the Veterans' Facility for further care. The diagnosis here was chronic enteritis, non-suppurative.

The Miller-Abbott tube has been used in some cases of small bowel obstruction with gratifying results. An illustrative case follows:

CASE 29: A 22-year-old private, first class, was wounded in the abdomen while in the South Pacific area in January 1943; ten perforations of the bowel were said to have been found and were closed. He also received a wound in the right shoulder at the same time, which healed promptly. While he was in an evacuation hospital, the hospital was bombed and the patient was wounded in the hand, but he recovered from this promptly. He was then transferred to the United States and eventually arrived at our hospital. In April 1943, he began to suffer from cramp-like periumbilical pain, suggesting a partial obstruction. A small bowel examination revealed a loop in the region of the umbilicus that seemed to be sharply kinked. There was some delay in the passage of contrast material through this area. The symptoms continued and after a few days definite evidence of an obstruction developed. A Miller-Abbott tube was passed into the small bowel with no difficulty. It progressed normally until it reached the region of the sharply kinked loop, where progress was completely arrested. The bowel was decompressed and after seven hours the tube passed the point of interference and progressed normally down to the cecum. The abdominal discomfort disappeared and in twenty-four hours the tube was removed. There was no further abdominal discomfort, and the patient was returned to limited duty in June 1943. The x-ray findings a month and one week before the obstruction took place and the findings following relief of obstruction are shown in Figure 57.

The double-contrast type of examination of the large bowel is employed in all patients suspected of having polyps and in all those where even a single polyp is demonstrated by sigmoidoscopy. An illustrative case history follows:

CASE 30: A 27-year-old private was transferred to our hospital from a station hospital with a history of rectal bleeding. He had an acute ulcerative colitis three years prior to induction. This lasted for ten months, during which time he lost 50 pounds in weight. He recovered, but one year later there was a recurrence of symptoms and he was sick for three months. On admission here his weight was found to be normal. He was passing three or four stools a day, some containing streaks of blood. Proctoscopic examination showed numerous polyps of the rectum and lower sigmoid and our x-ray examination showed a diffuse polyposis. All parts of the colon were involved. A biopsy taken from one of the polyps in the lower sigmoid was said to have exhibited only chronic inflammation with no evidence of adenomatous change From the x-ray standpoint, however, the findings seemed characteristic of a diffuse polyposis of the colon. The appearance of the colon was not that usually seen with an ulcerative colitis.

### THE URINARY TRACT

A surprising number of lesions of the urinary tract causing serious disability have been encountered in this institution. The most common finding is stones, which in many instances were present, but not recognized, prior to entrance on active duty. The results of treatment have been gratifying in most cases, although in some irreparable damage had taken place before suitable therapy was instituted. The importance of urinary tract stones as a cause of disability in the Army is shown by the fact that 67 patients suffering from this

Fig. 56. Case 28: Chronic non-suppurative enteritis. A and B. Two of a series of films of the small bowel made at our first examination, in September 1943. The bowel is tube-like in appearance. The margins of some of the portions in the right lower quadrant are irregular, and numerous small areas of decreased density are shown having the characteristic appearance of those resulting from polypoid changes in the mucosa. (It will be observed that the film in B is printed in reverse, left to right.) C and D. Two of a series of films made Jan. 17, 1944. These again show the bowel to be very abnormal in appearance, although some improvement is evident.

Fig. 57. Case 29: Intestinal obstruction. A and B. Roentgenograms showing condition of the bowel April 10 and May 6, 1943. Each shows a dilated loop (indicated by arrows) considered to indicate the presence of a partial obstruction at the point of narrowing just distal to the dilatation. C. Passage of Miller-Abbott tube following relief of partial obstruction. D. Condition of small bowel June 7, 1943. There is no suggestion of any abnormality of the small intestine. The distended loop demonstrated prior to complete obstruction and to the passage of the Miller-Abbott tube is no longer present.

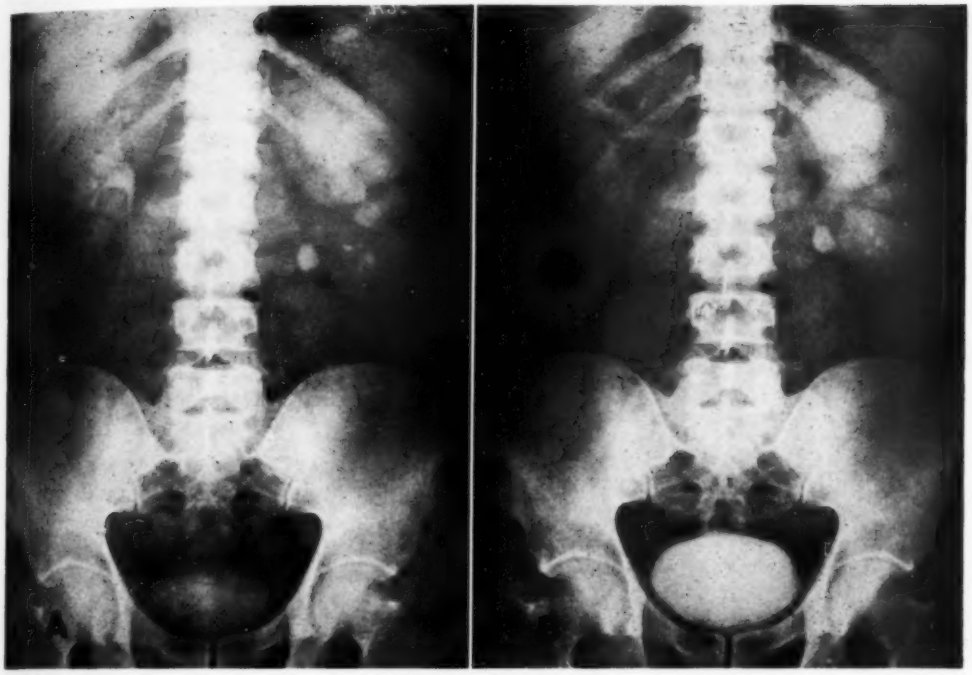

Fig. 58. Case 31: Renal calculus. A. Findings fifteen minutes after the intravenous injection of diodrast. The right side of the tract is satisfactorily shown and apparently normal. The minor calices are beginning to fill on the left and are obviously greatly dilated. The obstructing stone and calcification in the lower pole of this kidney are well demonstrated. B. Findings two hours after the beginning of the examination. All of the opaque material has now passed out of the right side of the tract into the bladder. The minor calices on the left are now well demonstrated, being greatly dilated. It is obvious that the cortex of the kidney is largely destroyed and that the stone is causing the high degree of obstruction.

condition were treated in our institution during the past twelve months. The following is an illustrative case:

CASE 31: A 38-year-old private, first class, was admitted to Percy Jones General Hospital Jan. 26, 1944. He gave a history of passing a small renal stone four years prior to his admission here. Since that time he had suffered dull aching pain in the left renal area at times. This was usually brought on by activity and relieved by rest. On Jan. 24, 1944, he was admitted to a station hospital because of severe chills and fever. Pyuria was noted, and urologic studies demonstrated multiple calculi in the left renal area. This diagnosis was confirmed in our hospital. The calices on the left were greatly dilated. It seemed evident that the cortex was largely destroyed, and a nephrectomy was done Feb. 16, 1944. Considerable induration was found in the perirenal fat, and the cortex was thin throughout. Postoperatively pneumonia developed, but penicillin was given and prompt recovery ensued. The findings in this case are illustrated in Figure 58 and show the importance of making exposures at intervals for a period of at least two hours in delay or apparent absence of excretion.

Next in frequency and importance have been those lesions having a congenital basis, such as pyelectasis resulting from obstruction by aberrant vessels or bands at the junction of the kidney pelvis with the ureter, or obstructions lower in the urinary tract. The following case history and findings illustrate a relatively rare lesion that may have a congenital basis:

CASE 32: The history and findings in this case were not of importance except for a mild hypertension. At our examination, shown in Figure 59, we demonstrated a cyst-like area that communicated with the superior calix of the left kidney. It was diverticulum-like in appearance. The structures seemed to be entirely normal otherwise, and it was not thought that this finding was significant. Two similar cases were reported by Natvig (2) in 1941.

Fig. 59. Case 32: Cyst-like pocket communicating with the superior calix of the left kidney. The finding was not thought to be of clinical significance. The structures are normal otherwise. This film is of interest in that it was secured by exposing an ordinary x-ray film to direct sunlight through the original film. The exposure time to direct sunlight was thirty seconds. The film was developed in the usual manner and the direct duplication shown in this illustration resulted.

All intravenous urograms are done in the X-Ray Department under the direction of the radiologist, who also does the injection. This is not an examination that lends itself to routine, the procedure being determined by the findings early in the examination. A so-called preliminary or scout film of the entire tract is always made prior to the injection of the contrast material. The first exposure, with a 14 × 17-in. film, is made approximately five minutes after the injection is completed. Unless contraindicated, compression is then made above the symphysis, using the compression band and a small football in order to block the ureters, the latter being accomplished in most cases. There are some examiners who object to compression, saying that this interferes with the normal dynamics. We are not in agreement with this, for the first film is always made before pressure is applied, and compression makes possible much more satisfactory visualization of the upper urinary tract than is otherwise possible.

Compression is maintained for approximately five minutes, after which stereoscopic views of the upper collecting systems are obtained, on 10 × 12-in. films. Immediately after these are secured, preparation

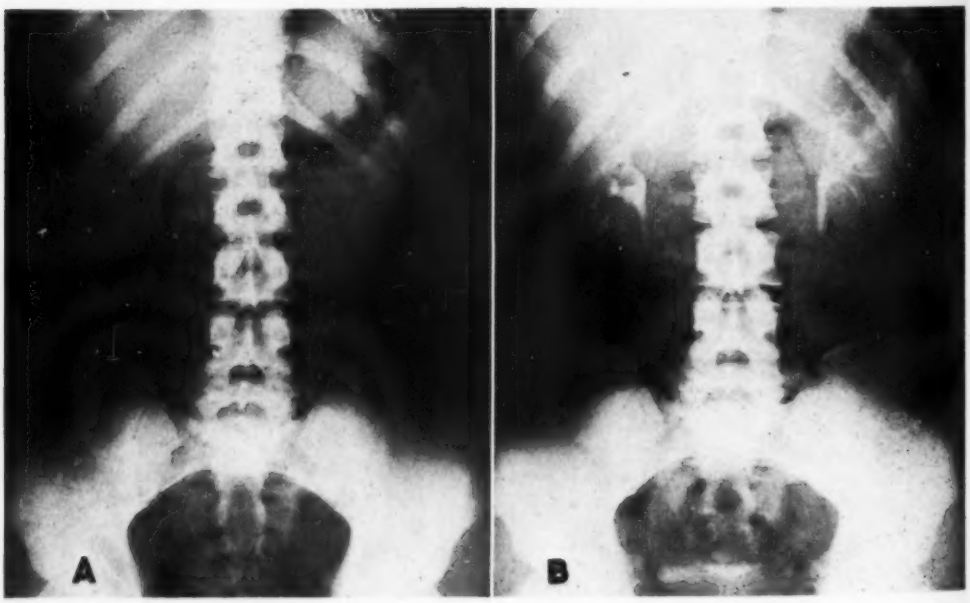


Fig. 60. A. Plain or scout film routinely made in all examinations of the urinary tract. B. Film made approximately five minutes after intravenous injection of diodrast. The upper part of the tract is satisfactorily shown and is obviously normal. A small amount of opaque material was in the bladder when this film was made.

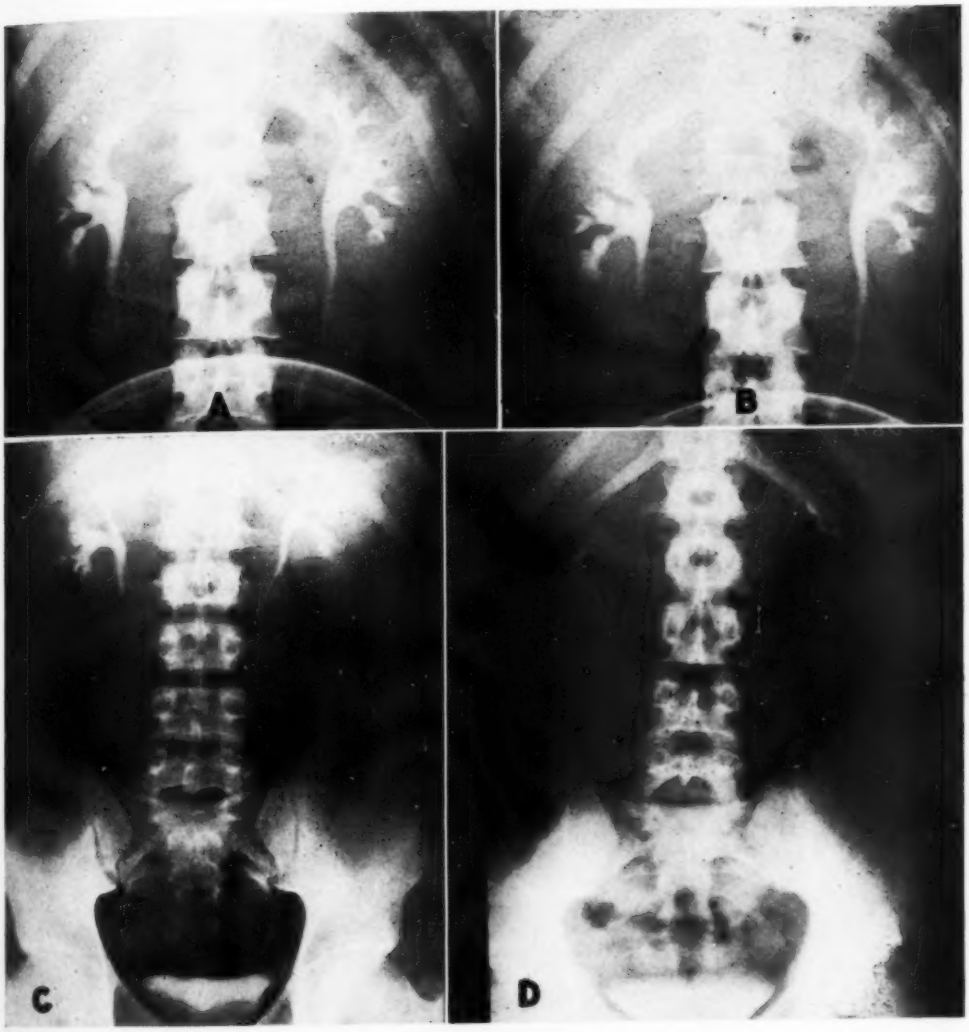


Fig. 61. A and B. Pair of stereoscopic films of the upper half of the urinary tract made approximately twelve minutes after the intravenous injection of diodrast and approximately seven minutes after application of pressure above the symphysis, a child's small football being employed to obtain satisfactory compression. As can be seen, the ureters are satisfactorily obstructed and the upper half of the tract is well visualized. No abnormalities are present. C. Urinary tract immediately following release of pressure above the symphysis. The lower portions of the tract, including the bladder, are most satisfactorily shown, as is usually the case in this film. D. Film made with patient upright, a routine exposure unless contraindicated. The pelves and ureters are seen to have emptied satisfactorily, and the kidneys are in essentially their normal positions.

These exposures and those in Fig. 60 are the ones made in intravenous urography unless others are indicated.

is made for an exposure of the entire urinary tract on a 14 × 17-in. film. The pressure is released and the exposure is then made. The distal parts of the ureters are usually well demonstrated on this film. At this time the first film made can be examined, and this will determine the subsequent procedure. If normal excretion is taking place, we next make a film of the entire tract with the patient upright, in order to determine whether or not abnormal movement of the kidneys is present and whether or not the pelves and ureters empty satisfactorily. The examination is

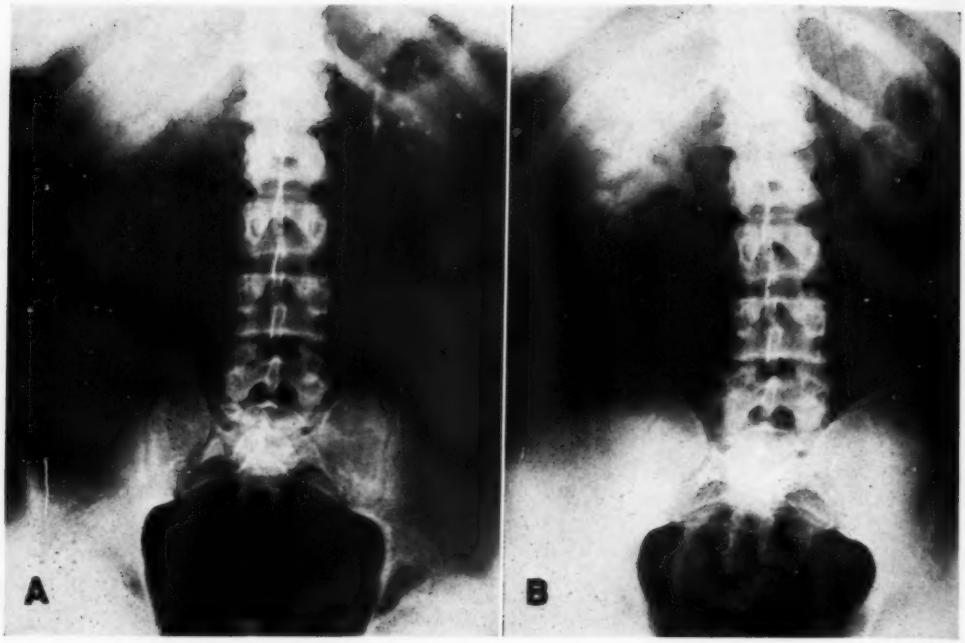


Fig. 62. Case 33: Ureteral calculus. A. Exposure made fifteen minutes after intravenous injection of diodrast, showing normal excretion to be taking place from the left side of the tract. The right kidney shadow is very dense, and only a suggestion of opaque material in dilated minor calices can be seen. Had the examination not been continued for a relatively long period, the examiner might well have assumed that the right kidney was not functioning. B. Film made two hours after the beginning of the examination, showing complete drainage to have taken place in the left side of the tract. The entire right side is now demonstrated, showing noticeable dilatation of the ureter and minor calices, with questionable slight dilatation of the kidney pelvis.

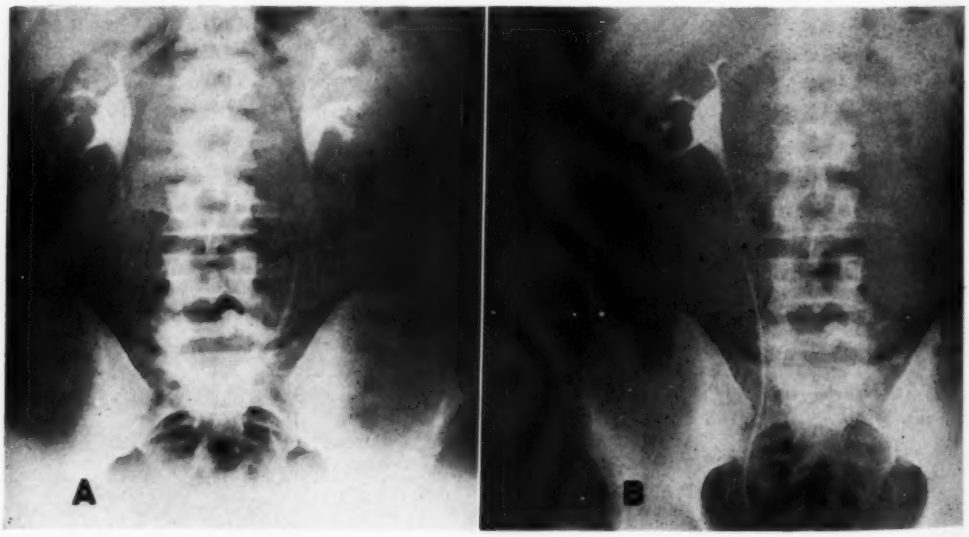


Fig. 63. Case 34. Carcinoma of the kidney. A. Findings during intravenous urography. The structures on the left are normal. The inferior calix on the right is deformed, a curved filling defect being present, suggesting pressure from a spherical mass of some type, thought to be a primary tumor of the kidney. B. Film made during retrograde examination. These two illustrations form a satisfactory basis for comparison of the two methods of examination.

then terminated. The routine exposures used in a normal case are shown in Figures 60 and 61.

If, on the other hand, normal excretion is not taking place, we continue the examination, making exposures at the intervals indicated by the findings in subsequent films. If excretion is delayed or apparently absent, the examination may be extended over a period of two hours, and one is frequently rewarded by satisfactory visualization in a kidney that would have been considered non-functioning had the examination been terminated earlier, particularly within the first forty-five minutes. When a stone is suspected low in the ureter, stereoscopic exposures of the lower urinary tract are made on 8 × 10-in. films, using a transverse shift. The history and findings in such a case follow:

CASE 33: A 23-year-old private, first class, had compound fractures of the tibia and fibula resulting from a gunshot wound suffered in the South Pacific in December 1942. While under treatment here, symptoms developed in the right ureter suggestive of a stone. Our intravenous examination showed dilatation of the pelvis, calices, and ureter on the right, together with a small shadow near the junction of the ureter with the bladder that had the appearance of a stone. The stone passed spontaneously and the pain subsided. Our findings are shown in Figure 62.

We test all patients for sensitivity to diodrast, placing a drop of this material in the conjunctival sac, as described by Archer, of the University of Virginia School of Medicine. Just what value this test may have is not known with certainty. We can only say that we refuse to do intravenous examinations in patients exhibiting a markedly positive reaction, of whom there have been relatively few. We have had no reactions of any consequence in the patients examined. Whether or not those with positive tests would have had reactions cannot be said. It is our opinion, however, that it is safer to make these few examinations by other methods than to take any chance.

Retrograde examinations of the urinary tract are done in the department of urology but under our direct supervision.

Fig. 64. Case 34: Photograph and photomicrograph of tubular adenocarcinoma of lower pole of kidney, invading the calix. The photomicrograph shows the tendency to reproduction of convolutional tubules.

Tumors of the kidney have been rare. An interesting one is shown in Figure 63, the history being as follows:

CASE 34: A 29-year-old private, first class, was transferred to our hospital with a diagnosis of hematuria of undetermined origin. He had been well until Nov. 22, 1943, when gross hematuria occurred. This persisted for five days and was accompanied by some discomfort in the right upper quadrant. An excretory urogram was made on Dec. 7, 1943, showing a deformity of the middle and lower calices of the right kidney considered to be due either to a malignant tumor or cyst. Because of history

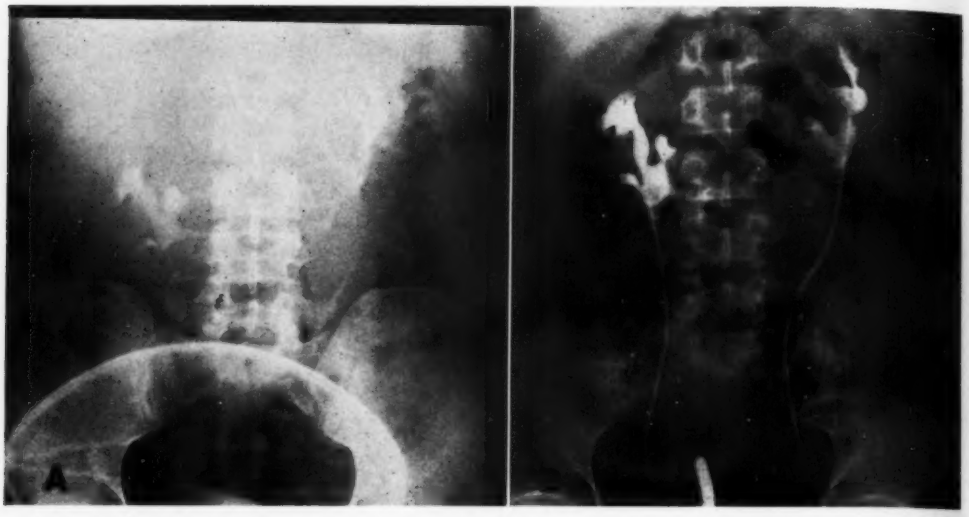

Fig. 65. Characteristic findings in a case of horseshoe kidney. An intravenous type of examination (A) was first done. It is obvious that a horseshoe kidney is present, but the characteristic changes are much more satisfactorily demonstrated by the retrograde method (B). An area of decreased density can be seen in the pelvis of the right kidney due to the presence of a non-opaque stone.

of gross hematuria, the former diagnosis was considered the most likely. Right nephrectomy was done, and a soft, well circumscribed tumor was found in the area where deformity was previously observed. There was no evidence of enlargement of the adjacent lymph nodes. Microscopic examination showed the lesion to be an infiltrating tubular carcinoma.

A horseshoe kidney is shown in Figure 65.

We have seen a number of testicular tumors, with disturbance of the urinary tract due to retroperitoneal metastases. The importance of excretory urography in determining the activity of testicular tumor implants in the preaortic and pararenal lymph nodes has been stressed by Chamberlin and Jamison (3). A characteristic appearance may be produced by this disease, the most frequent finding being lateral, or rarely downward, dislocation of the kidney with or without an obstructive uropathy. Although it is possible that such displacement may occur in other types of retroperitoneal tumor, it is rare in our experience. In those cases where intravenous urography is negative, this serves as a control to evaluate the patient's condition at a later date. It should be borne in mind that metastases from a left testicular tumor will usually involve the left renal hilum, while metastases from the right testis, due to the peculiarities of the lymphatic pathways, may involve either side, not infrequently being most prominent on the left. Even in the absence of a demonstrable testicular tumor this roentgen picture should bring to mind the rare possibility of an occult testicular neoplasm with large retroperitoneal implants. The relief of an obstructive uropathy or the return of function in a previously nonfunctioning kidney is an encouraging sign and may be of considerable prognostic significance. An illustrative case history follows.

CASE 35: A 36-year-old corporal was inducted in July 1942. He gave a history of having been operated upon for a right undescended testicle in 1924. During the winter of 1942 he began to suffer from night sweats and low back pain. In April he noticed he was losing weight, and what was thought to be a hydrocele developed following an injury in the course of exercise. Fifteen days later a large mass was noted in the right side of the abdomen. The abdomen was distended and there was a large, irregular nodular mass in the right upper quadrant, apparently obstructing the vena cava. The right testicle was greatly enlarged, and a firm, nodular mass was present. An intravenous examination of the urinary tract revealed a non-functioning kidney

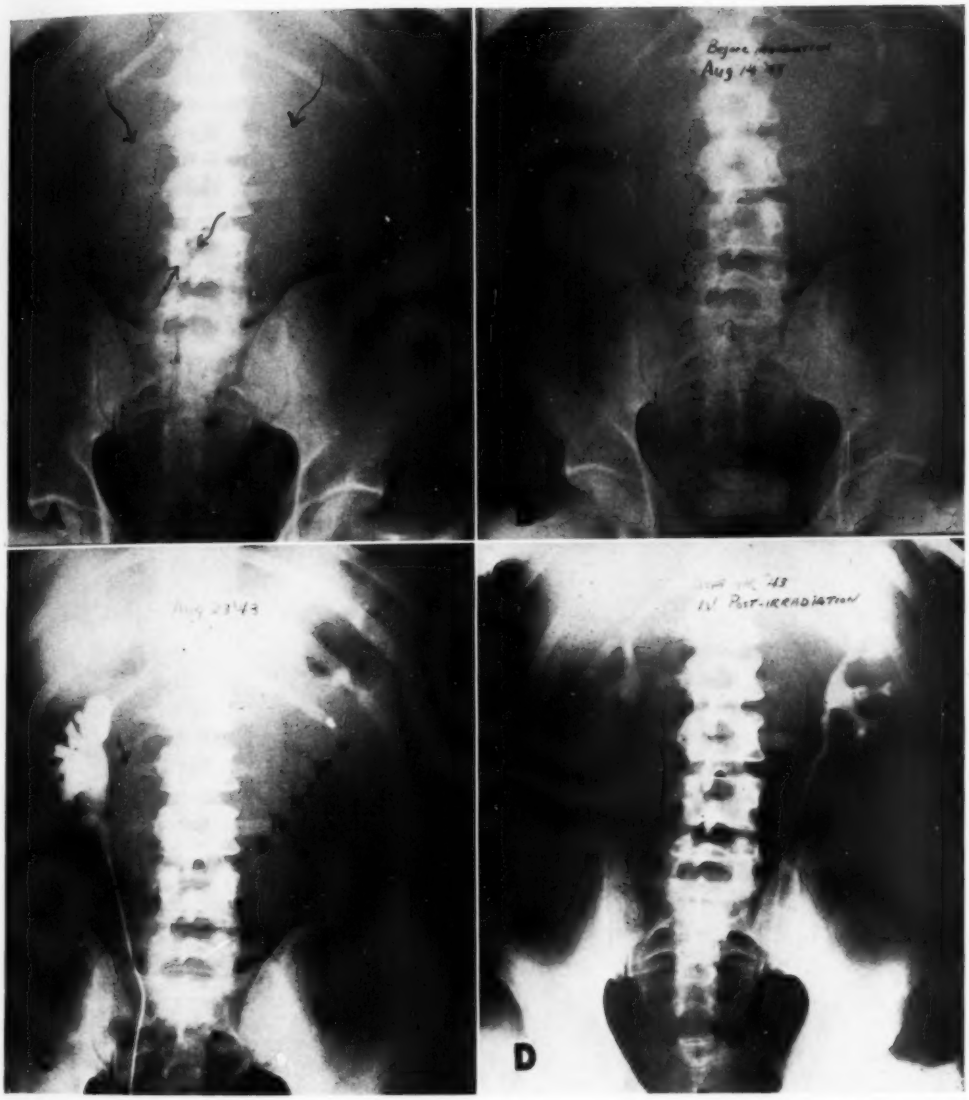


Fig. 66. Case 35. Malignant tumor of the testicle with obvious extensive metastases in the abdominal area. In A the left psoas shadow is seen to be largely obliterated and the right psoas shadow to be slightly hazy. The lower arrows demonstrate the defect in the posterior arch of the fourth lumbar vertebra due to a metastatic lesion. B. Findings on intravenous urography. The right kidney was apparently non-functioning, for no suggestion of opaque material could be found on the right side of the tract during the two-hour period following the injection. The excretion on the left was satisfactory, but the left kidney is seen to be displaced lateralward, presumably by retroperitoneal metastases in the kidney area.

C. Retrograde pyelogram on the right, nine days after the intravenous examination was done. The patient was receiving radiation therapy during the interval between examinations and had already shown considerable improvement. This illustration shows only moderate dilatation of the kidney pelvis and minor calices. The kidney is displaced lateralward and a faint shadow can be seen, indicated by arrows, apparently due to metastases. D. Findings on intravenous examination approximately one month after the patient was first seen. During the interval he received radiation therapy and showed marked improvement. The function of the right kidney has returned and the dilatation shown previously at the retrograde examination has largely disappeared. The displacement of the kidney is considerably less than in earlier examinations.

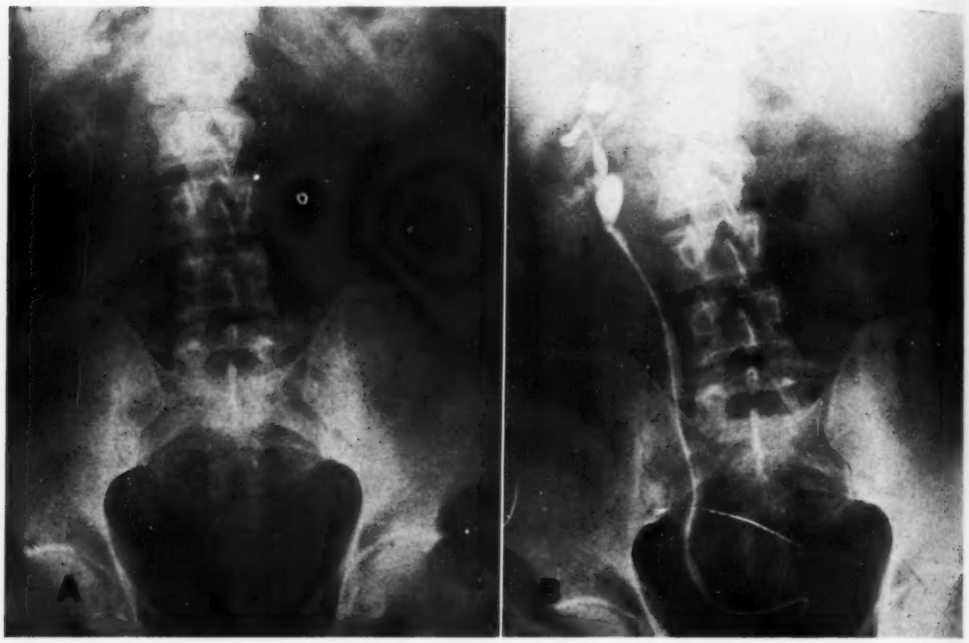

Fig. 67. Case 36: Tuberculosis of the kidney. A. Preliminary film made at the beginning of an intravenous examination of the urinary tract. It shows extensive calcification of the lower pole of the kidney and some calcification in the upper pole. Small prostatic stones can be seen above the symphysis. The intravenous examination showed changes obviously due to an extensive renal tuberculosis on the right. B. Film made following retrograde injection of contrast material. The pelvis is greatly deformed. The middle and inferior calices did not fill, and there was deformity of the superior calix. This kidney was removed later and showed extensive tuberculosis. Some of the lesions were active; others were largely healed.

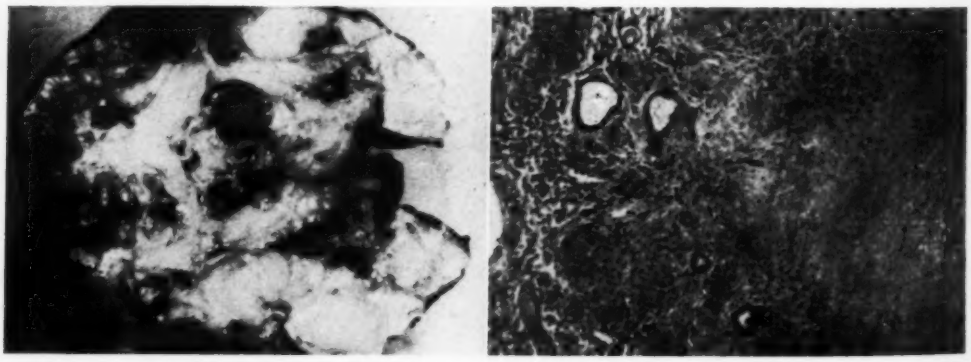

Fig. 68. Case 36: Tuberculosis of the kidney. The gross specimen shows extensive caseation with numerous minute areas of calcification. The lesions on the right are obviously old, while those on the left are of more recent origin. The photomicrograph shows a large area of necrosis on the right. On the left there is an attempt at regeneration of some of the tubules, indicating the long-standing nature of the disease.

on the right. Heavy radiation was given to the abdomen, the testicles, and the left supraclavicular area, where a firm palpable mass was found. The masses in the abdomen, supraclavicular area, and testicle regressed rapidly. A plaque-like tumor developed above the left side of the diaphragm, which also disappeared promptly after irradiation. The right testicle was removed, and the microscopic examination showed only fibrous tissue remaining. It was obvious, however, that the primary lesion was a malignant tumor. The patient did well, gained weight, and in January 1944 was discharged to the Veterans' Facility for further follow-up and care. Films of the urinary tract made before and

Fig. 69. Case 37: Large defect in the ulna resulting from a gunshot wound. The illustration on the right shows the repair of the defect by onlay grafts and bone chips.

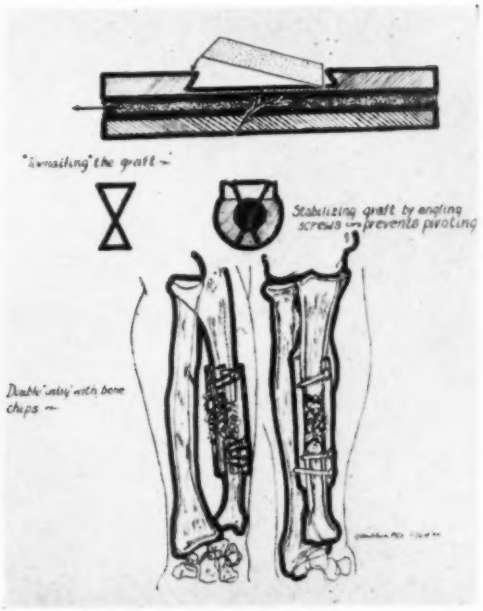


Fig. 70. Case 37: Drawings by Major Heublein from x-ray films, showing repair of defect in the ulna by onlay grafts and bone chips.

after irradiation, demonstrating return of function in the right kidney, are shown in Figure 66.

The following is an example of tuberculosis of the kidney.

CASE 36: A 44-year-old captain was admitted to Percy Jones General Hospital Dec. 17, 1943, complaining of pain on urination, urgency, frequency, and terminal hematuria for a period of ten days. He denied having any previous urinary symptoms. Examination showed irregular calcification in the right renal area together with multiple stones in the prostatic region. Tubercle bacilli were found in the catheterized specimen from the right ureter and a guinea-pig inoculation was positive. An intravenous examination showed evidence of destruction in the region of the lower pole of the right kidney. The function of the kidney, however, was not seriously impaired. Nephrectomy was done Feb. 5, 1944. The x-ray findings are shown in Figure 67. Examination of the removed kidney showed areas in which the infection was active and others where healing with fibrosis and calcification had taken place.

Fig. 71. Defect in the femur resulting from a gunshot wound repaired by onlay grafts.

### FOREIGN BODIES, BONE DEFECTS, AND FRACTURES

Metallic foreign bodies are encountered frequently in our battle casualties. They include shrapnel fragments from exploded land mines and tiny fragments said to be from explosive bullets. These have been seen in all parts of the body: in the skin and subcutaneous tissues, imbedded in the skull, in the brain, in the chest, in the extremities, and in many other places. Many foreign bodies may be present in a single patient, and these are often widely distributed. No attempt is made to re-

Fig. 72. Case 38: A and B. Ununited fracture of the scaphoid four months after injury, with evidence of aseptic necrosis of the proximal fragment. B. Use of a peg graft in the repair of the ununited fracture.

move them unless they are causing symptoms, which in most instances they apparently are not. Defects in soft tissues and in the bones adjacent to the foreign bodies are frequently observed, due to loss of bone and soft tissue substance resulting from the passage of the fragments of metal through these structures.

The following case histories and figures illustrate some operations employed for correction of bone defects and for nonunion of fractures. Internal fixation of fractures is used only where more conservative measures have failed.

Fig. 73. Ununited fracture of the distal end of the fibula, with repair by an inlay autogenous graft, as shown in the lower views.

CASE 37: A 23-year-old sergeant suffered a fracture of the ulna as the result of a gunshot wound received in the South Pacific in January 1943. A large segment of the middle third of the bone was shot away. He was treated at a station hospital and later evacuated to the United States and sent to our hospital. The defect was repaired by onlay grafts and bone chips as is indicated in Figures 69 and 70.

CASE 38: A 22-year-old corporal, while in the

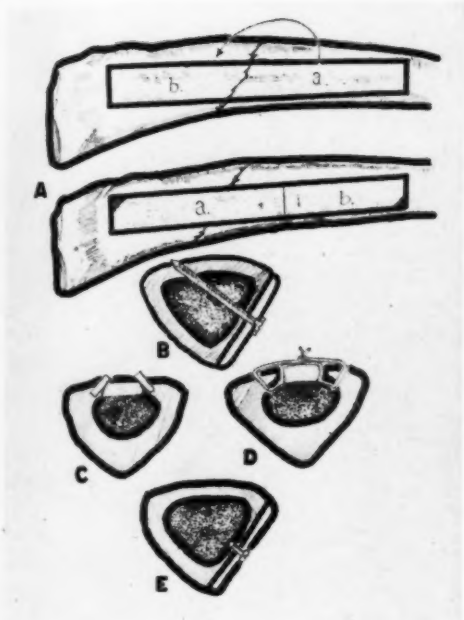


Fig. 74. Drawings by Major Heublein showing various types of grafts, slightly modified from Campbell. A. Sliding Albee inlay graft. B. Onlay graft, correct. C and D. Inlay grafts held by pegs (C) and by chromic (D). E. Onlay graft, incorrect.

South Pacific, received a fracture of the carpal scaphoid on Jan. 7, 1943. An examination at our hospital done April 12, 1943, showed some aseptic necrosis of the proximal fragment and cystic changes along the fracture line. It was evident that bony union was not taking place and a peg graft was inserted April 27, as is shown in Figure 72.

CASE 39: A 31-year-old private was injured in an automobile accident in this country July 13, 1943. He sustained an extensive comminuted fracture of the proximal third of the right femur. Our examination showed marked separation of the major fragments. Traction did not result in satisfactory reduction. At operation soft tissue was found to be interposed between the fragments. Reduction was done and the fragments were fixed with metal plates and screws as shown in Figure 75. Satisfactory bony repair took place, and the patient is to be returned to duty.

## COMMENT

The radiologist in an Army general hospital is afforded an unusual opportunity to see a wide variety of cases and to follow them in a way that is frequently not possible even in many of the best private institutions in this country. This is due to the fact that patients are discharged only after they have reached maximum hospital improvement, which not infrequently may require treatment over a period of many months.

In the Percy Jones General Hospital we have an adequately equipped department. In no instance has any tendency been shown to curtail the completeness of an indicated examination or to limit the number of necessary re-examinations.

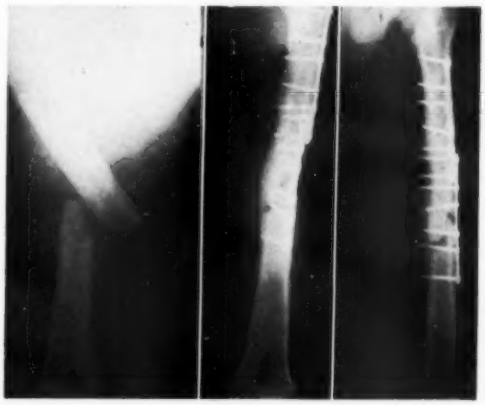

Fig. 75. Case 39: A. Extensive comminuted fracture of the femur with displacement of fragments. Satisfactory reduction could not be secured by conservative methods. An open operation was done, satisfactory reduction was obtained, and the fragments were fixed by multiple plates, as shown in B and C. These illustrations show the fixation screws passing well through the cortices.

The specialty of radiology is firmly established in Army general hospitals. That this is true is in a large measure due to the work of our pioneers in radiology, one of the greatest being the physician to whom we here pay tribute, Preston Manasseh Hickey.

Percy Jones General Hospital
Battle Creek, Mich.

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# Intra-Ocular Calcium Shadows; Choroid Ossification[1]

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THE ROENTGEN demonstration of calcification in the eyeball is rare. More frequently intra-ocular calcification is suspected on clinical examination and proved by subsequent dissection of the enucleated eye. Rollet (20) in 1913 was the first to report the discovery of choroid ossification by radiography. Subsequent observations have been added by Appelmans (1), Cuénod and Nataf (5) del Duca (6), Dunn (7), Guarnido (8), Hartmann (9), Huber and Picena (12), Issatchenko and Filatoff (14), Kaufmann (15), Perez Ara (17), Rocha (19), Salvador Junior (21), Satanowsky (23), de Souza Queiroz (26), Velter (28), Worms (29), and Wegener-Thomsen (30). While the majority of writers have contributed single observations, Worms, Rateau, and Leroux-Robert (29), Imai (13), Hartmann (9), Huber and Picena (12), de Souza Queiroz (26), Bane (2), and del Duca (6) were each able to report on several personal cases. Huber and Picena (12) were the last to contribute a comprehensive clinical and radiological study. Most observers agree as to the roentgen findings and the often histologically proved diagnosis of choroid ossification.

Twining and Shanks (27) distinguish four groups of intra-ocular calcium shadows: (1) calcification of the lens, (2) ossification of the vitreous, (3) calcified atheroma of the carotid and ophthalmic arteries, and (4) a shrunken calcified globe. Arteriosclerotic shadows are usually extrabulbar within the orbit or within the optic canal posteriorly to the globe. Shadows produced by intra-ocular calcium can be readily distinguished from those due to metallic foreign bodies, to siderotic impregnation following incomplete removal of metallic dust, and to residual thorotrast following orbitography.

According to Duke-Elder (25), bony cataract is fairly common in the late stages of a complicated cataract. This is well known to ophthalmologists, and numerous clinical and experimental observations have established the potential bone metaplasia of the choroid. Gluge in 1843, and later Kirk, Spree and Wittich, described the pathology of osseous cataract, and Virchow, Knapp, *et al.* have shown that the internal aspect of the choroid is the site of origin of this metaplasia. Virchow found that the ossification was usually associated with globular phthisis and that this was the result of a long-standing suppurative lesion following a severe injury of the eye. Samuels (22) and Zwiauer (31) have shown that the ossification is mainly confined to the choroid, with predilection for the posterior quadrant, while the iris and ciliary body seldom ossify. Samuels distinguishes three types: plates of solid bone, thick shells, and spicules of bone. Böck (4), Birich (3), Herrenschwand (10), Imai (13), and Schilling (24) have proved that ossification is the result of a degeneration of the lens fibers, no matter what the etiology of the cataract may have been. Sclerosis and necrosis occur first and in many cases degenerative changes follow, with calcium impregnation. Bane (2) believes that bone is formed from connective tissue through metaplasia of an organized exudate. Long-standing severe uveitis and subsequent disorganization of the eye favor deposits of bony tissue on the inner side of the choroid, starting usually near the entrance of the optic nerve and extending toward the ciliary body, often forming an almost complete osseous cup. This degeneration into ossification precludes a serious, long-standing inflammatory condition, which in many instances was primarily caused by a direct penetrating injury or by repeated, sometimes metastatic infection leading to cataract.

[1] From the Departments of Radiology of the New York Hospital and the New York Eye and Ear Infirmary. Accepted for publication in February 1944.

A clinical diagnosis of ossification of the choroid may often be suggested by the physical examination. Blindness, cataract, and the presence of a hard intraocular mass in an atrophic bulb are strongly suggestive. Sometimes the differential diagnosis may point to glaucoma, sympathetic panophthalmia, or tumor rather than to choroid ossification.

The diagnosis is definitely established by the roentgen finding of rather typical shadows of bony density in the globe. These findings as reported in the literature and as observed on our own material present striking similarities. Usually there is a shrunken eyeball, a large central area of which is occupied by a well delineated, fairly regular, ovoid, circular or semicircular, dense, although not strictly homogeneous, calcium shadow. This shadow occupies the region of the lens and extends more frequently into the posterior than into the anterior global hemisphere. With a luxated lens, the shadow shifts accordingly in an anterior or postero-inferior direction. Sometimes the shadow assumes the shape of a ring a few millimeters in thickness, with or without an isolated area of calcium density in the center or in a peripheral segment. The shape depends largely on the roentgenographic projection. In a few instances metallic foreign bodies have been observed near the calcium shadow. The roentgenographic image corresponds to the anatomic finding of shell-like ossification of the choroid and of the lens. There may be additional small calcium densities scattered throughout the eyeball according to the extent of the choroid and invasion of the cornea. All observers agree on the bony character of the lesions, and roentgen observations of calcium shadows of bone-like structures have been repeatedly reported. Opaque or semiopaque for-

Fig. 1. Case 1: Annular calcium shadows in both eyes.

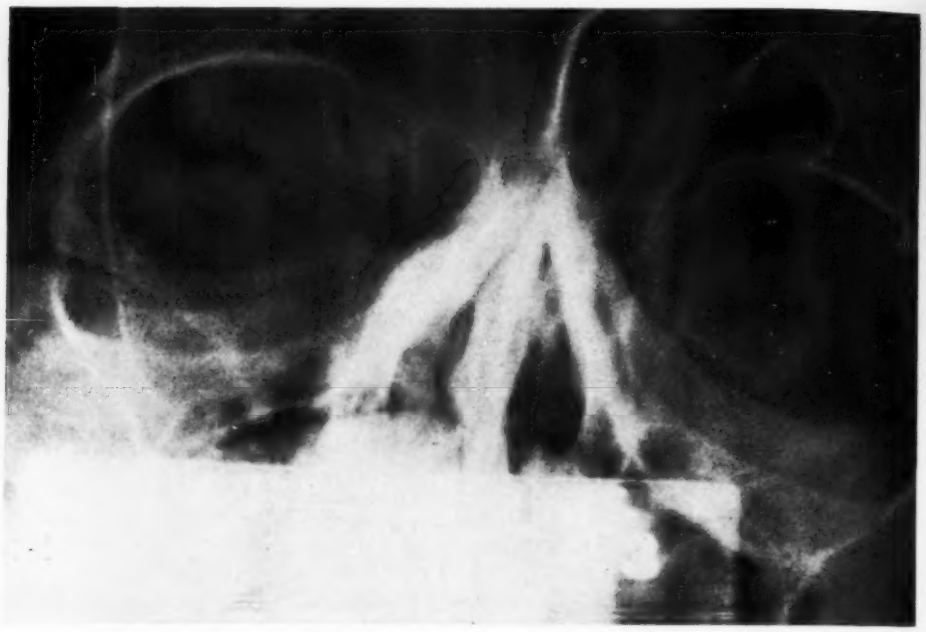

Fig. 2. Case 2: Shell-like calcification in right eye, with eccentric nuclear calcification.

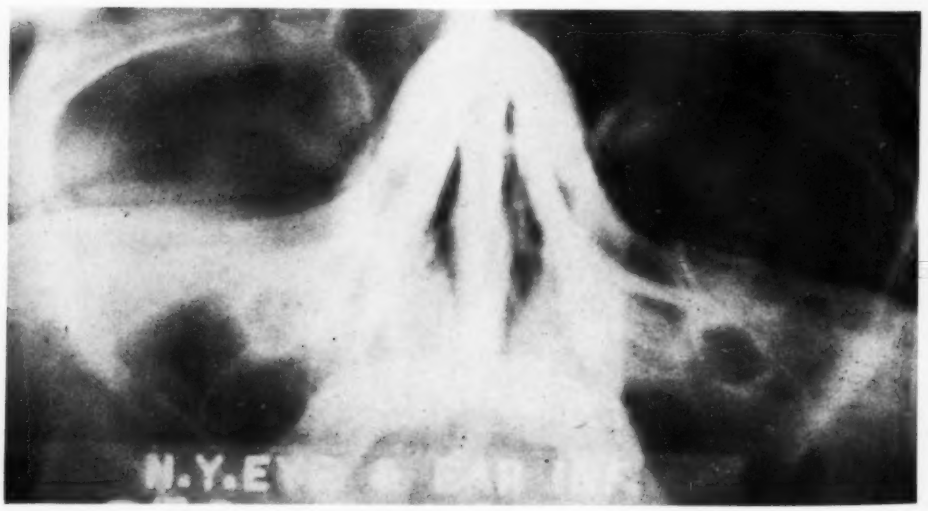


Fig. 3. Case 3: Thin shell-like calcification with nuclear calcification in right eye.

eign bodies, vascular calcifications, phleboliths, orbital angioma, osteoma, and endocranial calcifications offer no difficulties in differential diagnosis. Pfeiffer (18) has reported calcium deposits in congenital retinoblastoma in children. The preference for the infantile age group and the somewhat eccentric granular distribution of the calcium shadows in the eye help to distinguish these tumors from heteroplastic

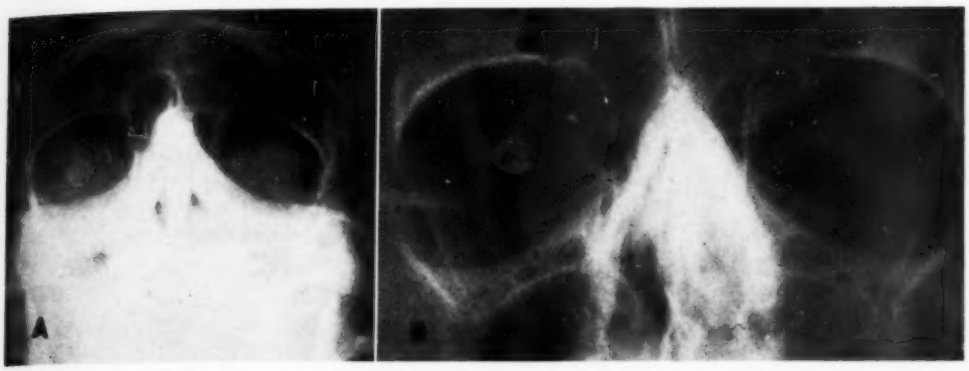

Fig. 4. Case 4: A. Calcification of lens and metallic foreign body in left eye. B. Same case six years later.

bone formation in the choroid. Few cases of the latter condition have been reported in children; the majority occur in and beyond middle age.

The radiographic picture varies according to technical factors, as in any other structure. It depends largely on the degree and extent of the calcium density and on adequate roentgen-physical conditions of the surrounding orbital structures. The bones of the orbit are apt to cause a blurring of the calcified mass to such a degree that the lesion is often overlooked or only faintly seen. Motion of the eye may completely erase a thin calcium plaque. This explains why, in spite of positive clinical and anatomical findings, reports of successful radiographic demonstration have been scarce. On the other hand, intra-ocular ossification has been observed on routine radiography as an unsuspected and incidental finding.

Three methods lend themselves best to the demonstration of intra-ocular calcium densities. The clearest view is offered by the postero-anterior projection of the orbit, by an additional lateral view as it is used for foreign body localization, and by the "bone-free" technic. The latter eliminates most of the surrounding structures and permits a clear view of the anterior two-thirds of the globe. We have used all methods and we have obtained satisfactory radiographic visualization in all cases. The orbit should be investigated in any radiographic study of the facial bones, skull, and sinuses. Some experience is necessary in regard to the confusing shadows of bony structures, sutures, and differences of the soft tissues of the globe and the fat capsule. Stereoscopic and planigraphic views and orbitography with air may still improve the roentgen demonstration.

CASE 1: A colored male of 21 years gave a history of cerebral and spinal meningitis at the age of thirteen. Chorioretinitis developed, followed by blindness of both eyes. Tuberculin tests and Wassermann reaction were negative. The right eye showed a corneal scar and the left scarring of both iris and cornea. There were no further neurological signs or symptoms.

*Final Clinical Diagnosis* (Dr. Samuels): Complete bilateral blindness probably due to chorioretinitis resulting from cerebrospinal meningitis.

*Roentgenography* showed in each orbit, slightly lateral to the center, an annular calcium shadow with radiolucent center (Fig. 1). The outer margins were irregular and there was a calcium plaque on the left, extending from the ring shadow in a lateral and downward direction.

CASE 2: A woman 49 years of age had fallen as a child and shortly afterwards lost the sight of the right eye except for some light perception. At the age of eighteen an operation was done on the right eye to straighten it. The patient did fairly well following this but in later years experienced pain in both eyes. Roentgen examination revealed a calcium shadow in the region of the right lens (Fig. 2). Histologic study of the enucleated eye led to a diagnosis of choroid ossification.

CASE 3: A middle-aged patient gave a history of a foreign-body injury to the right eye in childhood, with subsequent loss of vision. Roentgen examination revealed a spherical calcium shadow 1.5 cm. in diameter, irregularly calcified and occupying a large part of the eye. There was a complete outer shell and a central amorphous calcium deposit (Fig. 3).

CASE 4: A woman of 42 years came in 1937 and in 1943 for routine examination of the paranasal sinuses. No complaints referable to the eyes were recorded and no history was obtained. On both examinations a complete calcification of the lens and a metallic foreign body were seen in the left eye (Fig. 4 and Fig. 5D).

CASE 5: This patient was 55 years of age. A piece of steel had pierced the right eye almost thirty years before. There had been pain and redness of the eye for several months following the injury. The vision diminished gradually, and the eye became blind. The patient came for examination of the left eye. On this occasion the right eye presented the appearance of a chronic glaucoma and the tension to the fingers was maximum normal. Roentgen examination revealed a shell-like calcium shadow in the right orbit almost completely occupying a shrunken globe. There was no foreign-body shadow (Fig. 5C).

CASES 6 and 7: Two patients gave a history of foreign-body injuries many years prior to the present examination. Roentgenograms revealed in one case calcification of the capsule of the lens of the left eye (Fig. 5B) with a shrunken globe, and in the other case irregular plaque-like calcification of the capsule of the right eye (Fig. 5A). There were no foreign-body shadows present.

Several other cases have been seen in the past ten years but have not been recorded.

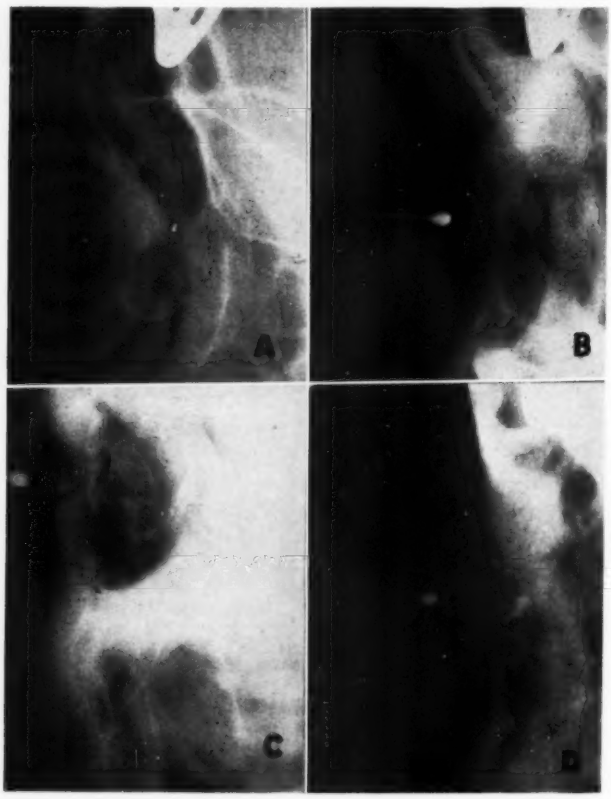


Fig. 5. Choroid calcification as seen in four different cases. Lateral views for foreign body localization.

The 7 cases reported involved in 1 instance both eyes, in 4 the right, and in 2 the left eye. Most of our patients gave a history of a foreign-body injury to the eye with subsequent signs of infection, deformity of the globe, and loss of sight. Pains persisted only for some time following the injury or recurred after a painless interval of several years. The first painful episode probably coincided with the acute and subacute infectious stage which forms the basis of the metaplastic choroid involve-

ment. The patients became accustomed to the anatomical lesion, and in only a few instances was enucleation of the eye performed. The majority of our patients were middle-aged, and accidental disturbances of the remaining eye or recurrence of pain in the previously damaged eye brought the lesion to medical attention. In several instances no complaints were recorded and the lesion was an incidental finding on sinus radiography.

## SUMMARY

1. Calcium shadows in the region of the lens have been repeatedly observed by ophthalmologists. Roentgenologic reports are scarce.

2. The authors have observed 7 cases of intra-ocular calcification and report their clinical, anatomic, and roentgen findings.

3. The anatomical lesion is a more or less extensive choroid ossification. The bony character of the lesion can often be disclosed radiographically.

4. The lesions can readily be seen on conventional roentgenograms of the orbit. Lateral foreign body localization exposures and "bone-free" technic improve the roentgenographic demonstration of intra-ocular ossification and determine the size, shape, position, and essential bony character of these shadows.

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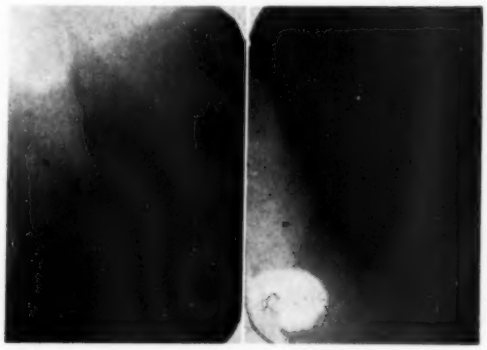

Fig. 6. Calcified lens (two cases) demonstrated by bone-free technic.

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# The Value of the Axial Projection of the Petrous Bone in the Diagnosis of Chronic Mastoiditis and Cholesteatoma[1]

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IN CHRONIC mastoiditis the pathological process is most frequently established within or near the mastoid antrum and tympanic cavity. In such cases, therefore, good roentgenographic demonstration of these structures is of paramount importance, but it is rarely if ever obtained by means of the routine projections.

Law's and Schueller's lateral projections portray the extent and condition of the pneumatized area, the mastoid process, and the venous sinus. Stenvers' and Granger's projections allow visualization of the petrous apex, upper petrosal ridge, inner auditory meatus, and labyrinth. Taylor's base view demonstrates the petrous apex and inner auditory meatus from a different angle and shows their relation to the sphenoidal sinuses. None of these views, however, demonstrates the mastoid antrum.

Recently, the cranially eccentric base views of Steward and Chamberlain-Towne have been recommended for problems concerning the mastoid antrum. In the author's experience, however, these do not display the wealth of detail and convincing clarity of the projection described some twenty-odd years ago by Ernst G. Mayer of Vienna. This view is technically difficult and intricate and the distortion of the temporal bone, with the exception of antrum, tympanic cavity, external auditory meatus and venous sinus, is considerable. Moreover, Mayer's instructions for placing the patient and arranging the tube and film cassette are difficult to follow.

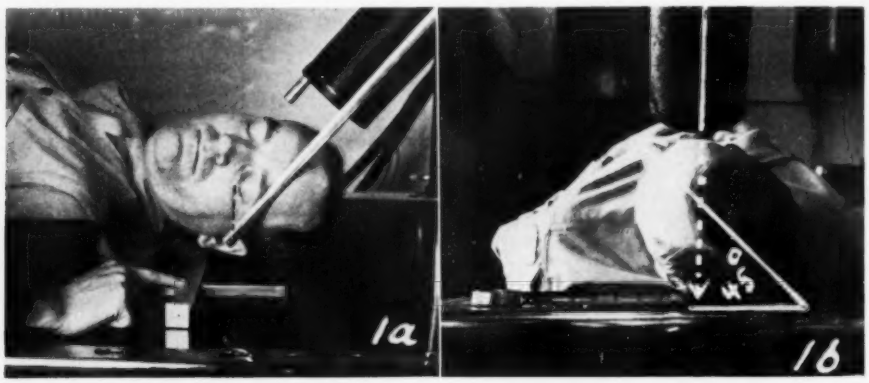



Fig. 1. Positioning to obtain axial projection of the petrous bone. Note the 45-degree caudal angulation of the x-ray tube, the direction of the central ray through the external auditory meatus, and the 45-degree lateral rotation of the patient's head. The technician's finger points to the yardstick for measuring the distance from the mastoid tip to the edge of the cassette. Use of this measured distance for exact centering to the mastoid tip is demonstrated in Figure 1*b*.

These difficulties probably explain why his projection has not become popular in the United States despite its undeniable merits. The purpose of this publication is merely to describe the positioning of the patient and the arrangement of tube and cassette more in detail, to give Mayer's useful projection another fair discussion, and further to add support by representative illustrations.

The basic idea of Mayer's oddly distorted view of the mastoid area is to obtain

[1] Accepted for publication in March 1944.

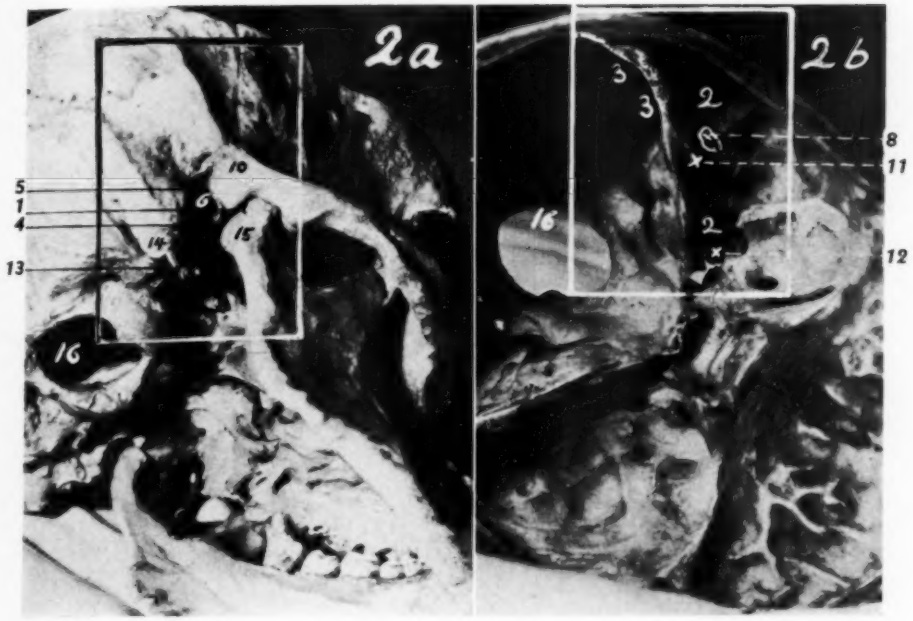



Fig. 2. External and internal views of the skull to demonstrate the unfamiliar anatomical features of the axial projection. To permit better comparison with the roentgenograms, the skull has been photographed upside down, thus compensating for the exaggerated downward projection of the petrous tip caused by the 45-degree caudal angulation of the tube. 1. Temporomandibular joint. 2. Petrous pyramid, vertically placed. 3. Groove of sigmoid sinus. 4. Anterior auditory canal wall. 5. Posterior canal wall. 6. External auditory meatus; in its depth the tympanic cavity is located. 8. Area of the tegmen antri. 10. Root of zygomatic arch. 11. Area of the labyrinth. 12. Carotid canal. 13. Styloid process. 14. Mastoid tip. 15. Head of mandible. 16. Foramen magnum.

a roentgenographic demonstration of the mastoid antrum, attic, tympanic cavity, and posterior auditory canal wall, particularly in conditions where sclerosis of the petrous bone has developed. In his projection the central ray strikes the temporal pyramid at an acute angle along its longitudinal axis (Fig. 1), resulting in a greatly distorted view of the petrous bone (Fig. 2). The antrum, attic, tympanic cavity, and posterior canal wall are, however, ideally visualized, undistorted, free from superimposed bone structures, presenting a surprising wealth of detail, "as if a curtain has been lifted from these structures."

## TECHNIC

(*Fig. 1a and b*)

*A. Positioning the Patient and the Film Cassette*

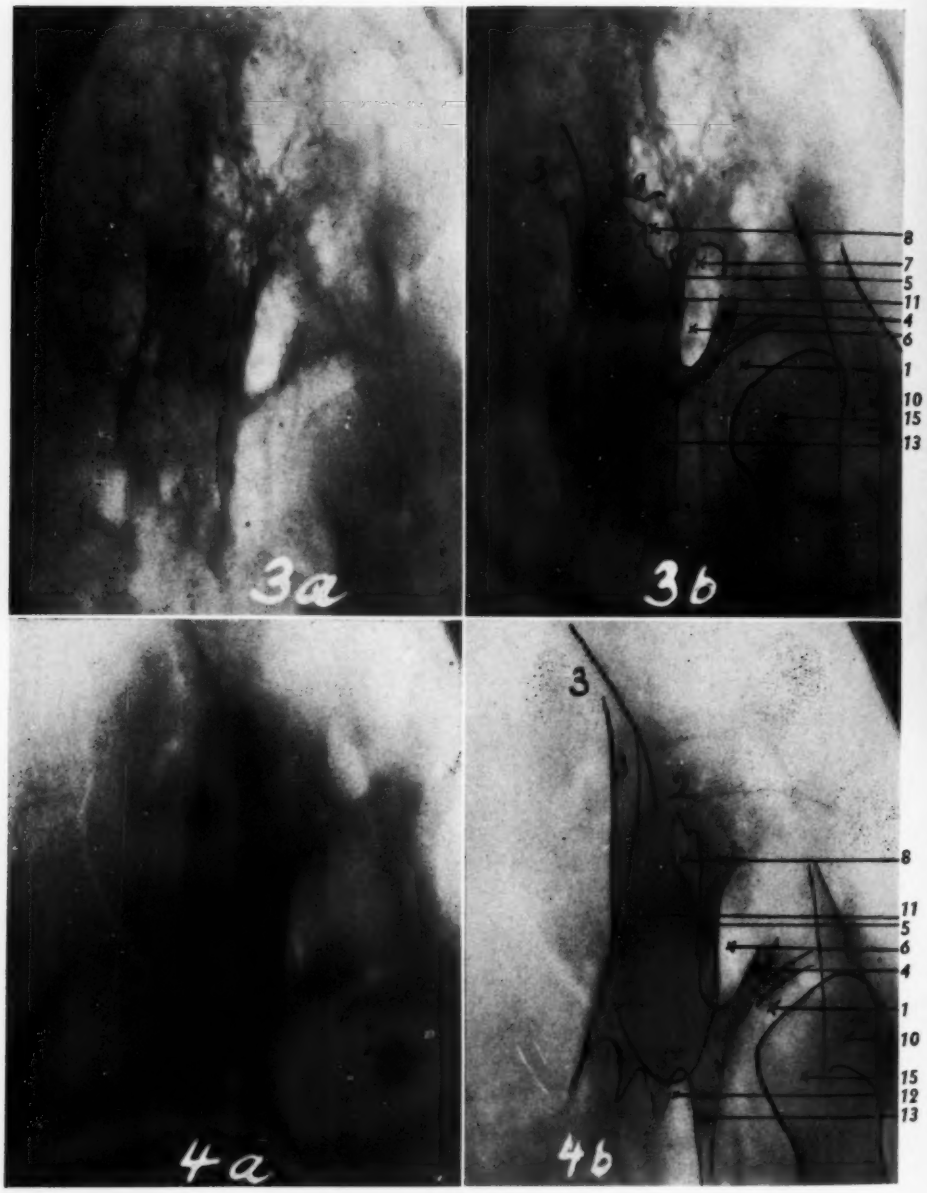
(1) Assuming that the *left mastoid* is to be examined, place the patient in the supine position with the chin depressed sufficiently so that the base line of the skull—connecting the infraorbital ridge with the osseous external auditory meatus—assumes a vertical position.

(2) Place the film cassette, size 8 × 10 inches, lengthwise so that its upper edge is about one inch above the upper border of the auricles, its lower border below the left shoulder region, its left edge about 3 or 4 inches beyond the left lateral border of the skull. (The technician experienced in this work will improve the quality of the films by using a cassette 5 × 7 inches and elevating the upper and the left edge of the cassette.)

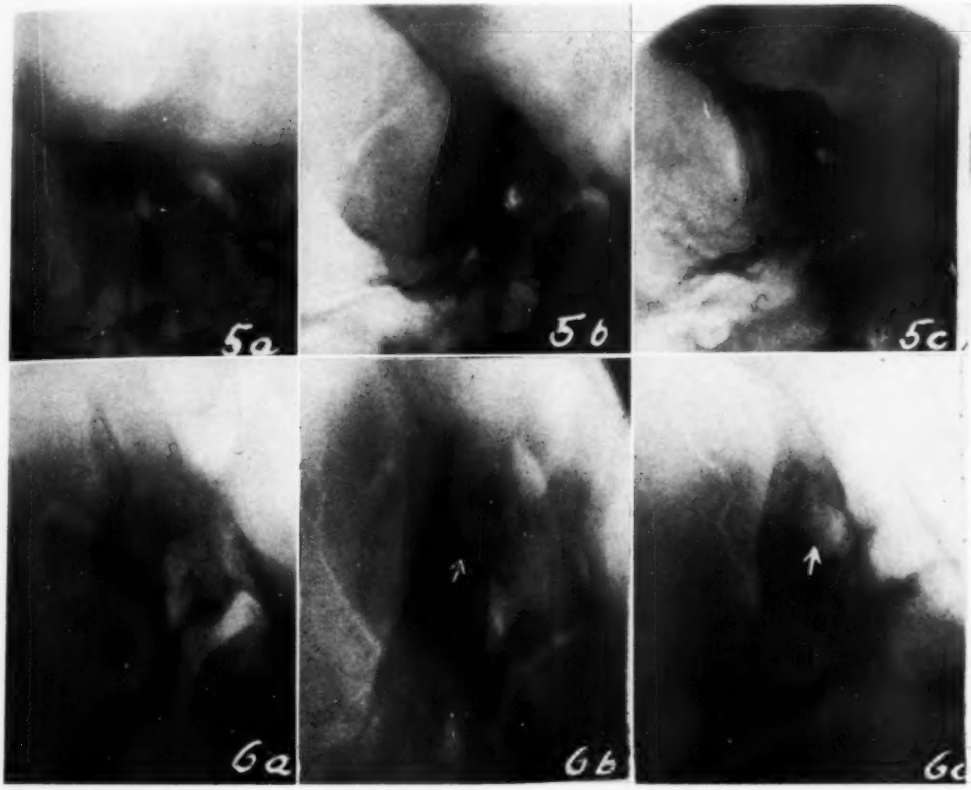
(3) Rotate the patient's head for exactly 45 degrees laterally toward the left side, but avoid tilting in any direction. Fold the left auricle forward and keep in position by means of a soft paper ball.

*B. Centering the Tube*

(4) Stand at the side being radiographed, tilt the tube for 45 degrees caudally, and direct the central ray through the external auditory meatus of the left ear.




Figs. 3 and 4. Normal well pneumatized mastoid and sclerotic mastoid, respectively, both in axial projection. 1. Temporomandibular joint anteriorly. 2. Petrous pyramid, appearing as a broad vertical shadow band. 3. Venous sinus posteriorly. 4. Anterior canal wall. 5. Posterior canal wall. 6. Tympanic cavity and superimposed external auditory meatus. 7. Epitympanic recess (attic). 8. Antrum. 9. Periantral cells. 10. Root of zygomatic arch. 11. Area of the labyrinth. 12. Carotid canal. 13. Styloid process. 14. Mastoid tip projected into the shadow of the petrous pyramid. 15. Head of the mandible.




Figs. 5 and 6. Three sclerotic mastoids are shown in Figure 5, in routine lateral (Schueller's) projection. These are of almost identical appearance, and the antra are not demonstrated. Figure 6 shows the same mastoids in axial projection. Complete failure of antrum development in *a*, a narrow, slit-like, cloudy antrum in *b*, a large antral-periantral cavity in *c*. In case *b* at operation granulation tissue was found in the small antrum, in case *c* a chronic purulent-granulating cavity.

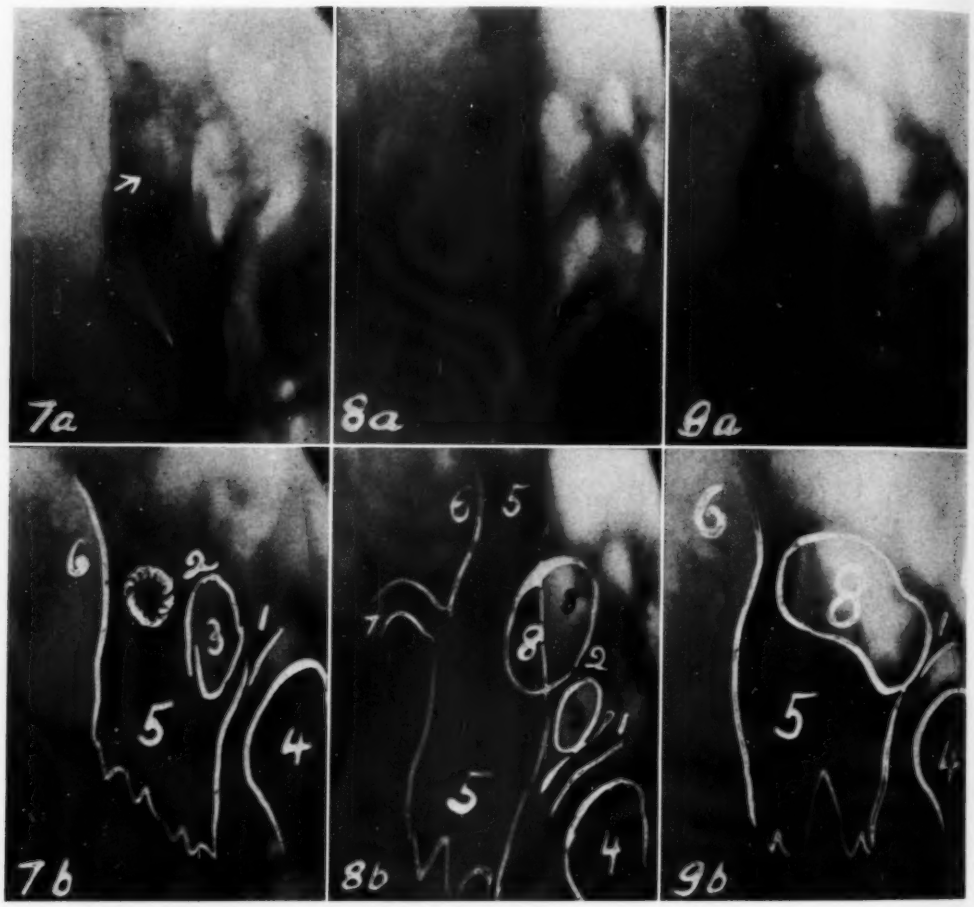
(5) After the tube has been longitudinally centered, measure the distance from the tip of the left mastoid process to the left lateral edge of the cassette on a small ruler.

(6) Now, standing at the head end of the table, direct the central ray through the left mastoid process by placing the ruler along the upper edge of the cassette and making use of the measurement just obtained. At the same time the central ray should strike the cassette near its longitudinal mid-line. If the centering was done correctly, the central ray will enter the skull above and slightly lateral to the middle of the right eyebrow.

(7) Use special mastoid cone or narrow extension cone.

(8) Exposure data on our equipment (four-valve rectified Keleket unit) are: 58–64 kv.; 30 ma.; 1 1/2 seconds; distance 30 inches; intensifying screens; no Potter-Bucky grid.

The special anatomical details more clearly demonstrated in this projection, as compared to those commonly used, are further enumerated and illustrated in Figures 2, 3, and 4 and their legends. It is amazing how clearly the antrum is demonstrated in instances of undeveloped pneumatization or sclerosis of the petrous bone by means of Mayer's projection. Figures 5*a*, *b* and *c* are routine lateral Schueller projections of three different sclerotic mastoids. The roentgenographic appearances are almost identical and practically nothing is seen beyond the general increase in bone density. "Lifting the curtain" by employing the axial projection, we note in Figure 6*a* an almost complete lack of antrum development, in Figure 6*b* a slit-like

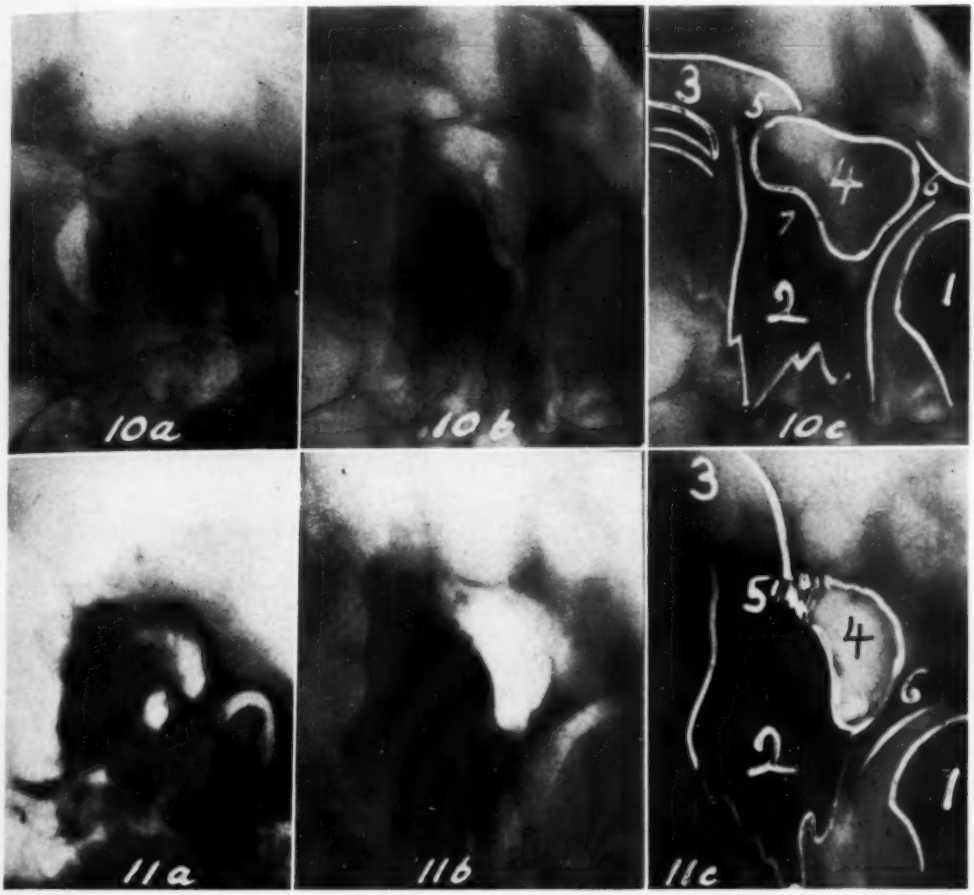



Figs. 7, 8, and 9. Axial projections of three different cases of chronic mastoiditis with periantral cavity formation. Figure 7 demonstrates an ill-defined cloudy cavity of moderate size caused by a simple chronic recurrent antrum suppuration. Figure 8 reveals a typical large, smooth-walled cholesteatoma cavity, the posterior canal wall (at 2) is intact. Figure 9 shows an enormous cholesteatoma cavity, now including antrum, attic, and tympanic cavity. The posterior canal wall is totally destroyed. 1. Anterior canal wall. 2. Posterior canal wall. 3. Tympanic cavity and superimposed external auditory meatus. 4. Head of the mandible. 5. Petrous pyramid. 6. Sigmoid sinus. 7. Mastoid emissary. 8. Pathologic cavity.

infantile cloudy antrum, and in Figure 6*c* a surprisingly large antral and periantral cavity.

When a large central cavity deep in the petrous bone is present, this will show on the routine lateral view, but the axial view will demonstrate it free from interfering bone shadows and will furnish important additional information. It will enable us to judge the presence or absence of cloudiness, the condition of the walls of the cavity, and its relation to neighboring structures (Figs. 7, 8, and 9). In all cases exact information may be given whether the posterior canal wall is intact or whether it has been destroyed, thus leading to the condition commonly known as "spontaneous radical mastoid" (Figs. 9, 10, and 11). Extension to the osseous capsule of the labyrinth and perforation through the osseous sinus wall into the posterior fossa are important details which are clearly demonstrated (Figs. 10 and 11).

We have to be aware of several impor-




Figs. 10 and 11. Two cases of large cholesteatoma. Figure 10*a* shows on the routine lateral view of the mastoid a typical, large, smooth, kidney-shaped cavity. Figures 10*b* and *c*, the unobstructed axial view, demonstrate that the cholesteatoma has broken through the anterior sinus wall into the posterior fossa, that it extends medially as far as the labyrinth and anteriorly close to the temporomandibular joint. Figure 11*a* shows a large cholesteatoma on the routine lateral view. Figures 11*b* and *c*, the axial view, reveal the cholesteatoma cavity projected out of the disturbing density of the petrous pyramid. The cavity is cloudy in its posterior portion and has broken into the posterior fossa through the sinus wall. A considerable osseous reaction is seen behind the break-through. 1. Head of the mandible. 2. Petrous pyramid. 3. Sigmoid sinus. 4. Cholesteatoma cavity. 5. Area of perforation through the sinus wall into the posterior fossa. 6. Anterior limit of the cholesteatoma, at the same time anterior canal wall. The posterior canal wall is totally destroyed in both cases.

tant limitations in diagnostic interpretation:

(1) Roentgenographic differentiation of an undeveloped, diploic, not diseased mastoid from a chronic sclerosing mastoid without antrum enlargement is not possible on purely roentgenologic criteria. If clinically the ear is diseased, we infer the presence of a chronic sclerosing mastoiditis and can inform the otologist that there is no pathologic cavity deep in the bone and that the antrum is small.

(2) A cholesteatoma which has attained a considerable size is easily diagnosed as such during the quiescent stage by its smooth, regular borderline. During an acute exacerbation, this distinct borderline becomes dissolved and markedly blurred, thus making a differentiation between a granulomatous, purulent enlarged antrum and a cholesteatoma in the stage of acute exacerbation impossible (Fig. 7). No error should be made, however, in reporting

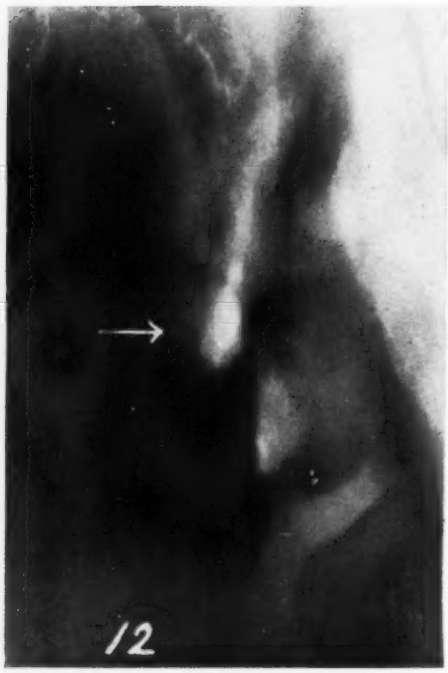



Fig. 12. Postoperative clean cavity following mastoidectomy. Without the clinical data, differentiation from a small quiescent cholesteatoma is not possible. Compare with the cholesteatoma pictured in Figure 8.

the presence, size, and exact position of the cavity in the petrous bone.

(3) A postoperative defect may at times present an appearance similar to that of a cholesteatoma (Figs. 8 and 12). The clinical history of any previous operative procedure that was followed by an uneventful recovery and permanent disappearance of discharge would decide the differentiation between the two conditions.

In the typical pathologic cases, however, the x-ray findings are so remarkably diagnostic that we may well stand our ground even if the opinion of the otologist should at first be contradictory. The percentage of roentgenological errors is low, once experience in analyzing these films has been gained. All pertinent pathological cases mentioned in this paper have been verified by operation.

## CONCLUSIONS

1. The axial projection of the petrous bone described by E. G. Mayer is considered a valuable technic in cases of chronic mastoid disease.
2. The anatomical and technical features of the axial projection of the petrous bone are described and illustrated in detail.
3. The different types and degrees of chronic inflammatory changes at the mastoid antrum are illustrated on cases corroborated at operation.
4. Several differential diagnostic limitations are discussed.

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# Photofluorography for Chest Surveys[1]

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THE PROBLEM of the detection and control of tuberculosis has been and still is one of paramount importance. Not only is it of interest to the Government, so far as the military forces are concerned, but it is also or should be of considerable concern to the man on the street. Even though great progress has been made in the control of this disease, there remains room for improvement.

We are well aware of the fact that it is of the utmost importance in the control of tuberculosis to find the apparently unsuspected case and to place the subject under supervision and treatment to bring about his cure and prevent the spread of the disease among his associates. The moderately advanced and advanced cases present no great problem, for the symptoms are usually such as to lead the patient to seek professional advice. Even here, however, there are exceptions, as in many moderately advanced cases subjective symptoms are absent.

While we are interested in all types of chest disease, we are primarily concerned with tuberculosis, and especially those patients with minimal lesions. These are the individuals that walk the streets of our cities, ignorant of the fact that they have the disease, unknowingly jeopardizing their own lives and the lives of those with whom they come in contact. We have the means at our disposal to find these cases, namely mass radiological surveys. In years past such surveys were impracticable because of the extreme cost. As a result of improvements in technic and equipment, however, we now have a relatively inexpensive method, *photofluorography*.

This method of examination is practical, adequate, and reliable. Numerous investigators have written upon this subject, giving the general impression of its adequacy. I wish, from my experience, merely to confirm this impression. There is no better way of doing so than by a review of the work done as roentgenologist at the Naval Training Station at Great Lakes.

There are four methods of conducting chest surveys.

The *first* is the use of standard 14 × 17-inch films. Without doubt this is the best method so far as reliability is concerned, especially if stereoscopic views are obtained. It is, however, impracticable for mass surveys because of the expense, lack of speed, and the problem of filing. The estimated cost with this method is approximately a dollar and seventy-five cents per case, which includes the cost of material and upkeep of the machine but not the cost of labor.

The *second* method is the use of 14 × 17-inch paper films. This method is adequate so far as speed is concerned (7 per minute) but has its disadvantages; namely cost, which amounts to about seventy-five cents to a dollar per case, the problem of filing, and the eyestrain involved in reading the films, since indirect lighting must be used and this creates a glare upon the shiny surface of the paper. Furthermore, the reliability is somewhat questionable.

The *third* procedure is the photofluorographic method, using 4 × 5-inch films with stereoscopic views. This I believe to be the most adequate. It is inexpensive, with an estimated cost of approximately ten cents per case, and reasonably rapid (5 per minute); filing is simplified, as the film can be attached to the permanent health record, and the reliability approximates very closely that of the standard 14 × 17-inch film. The percentage of error with this method should be as low as that with the large film. The 4 × 5-inch films can be read without magnification.

[1] This paper is published with permission of the Bureau of Medicine and Surgery, U. S. Navy, which assumes no responsibility for statements or conclusions reached herein. Read by title at the Twenty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 1–2, 1943.

The *fourth* method is that using 35-mm. films. This method is also adequate and reliable; the cost is minimum, approximately three to five cents per case; filing is simplified, as the film can be attached to the permanent health record, and speed is gained (6 to 7 per minute). The size of the film, however, is a slight disadvantage, because of the possibility of missing minimal lesions, especially if they are extremely small, and last, but not least, because of the strain on the eyes of the roentgenologist.

I have had experience with all of these methods, having had the privilege of reading and reporting upon over 5,000 paper films, over 2,000 4 × 5-inch films, and well over 300,000 of the 35-mm. films. This last method was the one used at Great Lakes Training Station.

The equipment at our disposal consisted of a standard 200-ma. x-ray machine with a movable tube stand. The tube was oil-immersed, air-cooled, and had a stationary anode. The photofluorographic unit consisted of a funnel-shaped tunnel with the fluoroscopic screen and grid at the large end and the camera attached at the small end. The camera was a large Leica with a film capacity of 30 feet, with an f 1-5 lens. The screen film distance was 36 inches and the tube film distance 40 inches.

The tube and camera unit were fixed in position. The patient was raised or lowered in front of the screen by means of an electric elevator. Each patient was measured for thickness of the part to be x-rayed, and the kilovoltage and time were varied accordingly. The film used came in 100-foot rolls. This was cut into 33-foot lengths to fit the camera. Each filling accommodated 200 exposures. The developing of the film was relatively simple, standard solutions being used. The time consumed in processing the film, that is developing, fixing, and drying, was usually about one hour.

As a routine, an average speed of 240 cases an hour was maintained, although on a few occasions we reached 420 per hour. It was found that the rate of 240 an hour was most economical from the point of view of wear and tear on the tube and machine. The average life of a tube was about 57,000 exposures. One tube gave 10,000 exposures, while another gave 140,000. Seven tubes were used for a total of well over 400,000 cases.

The largest number of cases for one day was 3,200 and the largest for any month was 41,989. The speed of interpretation with brief reports was 400 per hour. Our department included 14 x-ray technicians. Six of these men operated the machine and dark room; the others were engaged with the clerical work. The system used was more or less universal throughout the Armed Forces. Each man entering the station had a micro-film taken of the chest. The films were identified with the patient by means of the date and number. The reports for our files were kept on cards giving the name of the man, his company number, date of examination, and a number which corresponded to the number on the film, with a space at the bottom for diagnosis. This card was kept for the permanent files and the micro-film was placed in a small envelope attached to the man's health record, which was sent to the Bureau of Medicine and Surgery in Washington.

If anything of a suspicious or pathological nature was found in the micro-film, the man was called back for a recheck with 14 × 17-inch film. If the diagnosis now was of pathological significance, the patient was referred to the Naval Hospital for disposition. At the hospital he was again given a thorough examination and his case was submitted to the Board of Medical Examiners for final decision. If this board decided, for example, that the patient had an active case of tuberculosis, he was surveyed from the service and was sent home; the Red Cross notified the Board of Health in his home town of the facts, and they in turn saw that he had proper care and supervision. A careful record of all such cases was kept at the Naval Hospital.

Thus far I have dealt entirely with the technic of the mass survey. I now have a report to submit, based upon 400,263 cases examined with the 35-mm. technic.

These 400,263 cases represent a good cross section of the male population of our country. The men were from all walks of life and from all parts of the country. Their ages ranged from seventeen to forty-five, with the vast majority in the eighteen- to thirty-five-year group. This report is a compilation of the monthly reports that we were obliged to submit to our commanding officer, who in turn submitted them to the Bureau of Medicine and Surgery. These reports had to be accurate and well substantiated.

As to the accuracy of this report we had a definite check. At the end of each month films and reports were returned to our station from the hospital with data concerning correction of diagnosis and disposition of the patient. For a basis upon which to figure percentages, I have chosen two average months, a total of 41,616 cases.

| | |
|---|---|
| 1. Number rechecked by 14 × 17-inch films | 317 (0.76%) |
| 2. Number sent to hospital for dispositon and confirmation of diagnosis | 112 (35% of rechecks) |
| 3. Number of confirmed diagnoses | 96 (85.7%) |
| 4. Number of diagnoses changed | 16 (14.28%) |
| (*a*) Active tuberculosis *to* inactive tuberculosis | 7 |
| (*b*) Pneumonitis *to* atypical pneumonia | 3 |
| (*c*) Active tuberculosis *to* atypical pneumonia | 2 |
| (*d*) Inactive primary tuberculosis of possible future significance *to* no significance | 4 |

The changes of diagnosis listed were not due to the method, as the lesions were discovered on the 35-mm. film and reported as of pathological significance. They may be classified as errors in interpretation.

These 16 errors in judgment are in a way excusable. The diagnoses were made from the x-ray film alone, with no history or other clinical data as an aid. We were well aware of the fact that such diagnoses should not be made with assurance from a single x-ray film. Inasmuch as we had no choice in the matter, we made our diagnoses as pessimistic as possible, so that the burden of proof rested with the Medical Board at the hospital. Our error was at least on the safe side. Also, we wish to call attention to the fact that of 317 cases rechecked with standard films, only 112 or 35 per cent were sent to the hospital for further examination. In other words, we were using a 65 per cent factor of safety. We do not believe that much was missed under these circumstances.

Since the beginning of the survey, 6 patients with negative diagnoses have been hospitalized with active tuberculosis. Two of these cases were found after two months of service, one after four months, and three after six months. As far as these six cases are concerned, there are two possibilities. *First*, because of the smallness of the x-ray film and the size of the lesion, they were missed or the lesion was seen and an error in diagnosis was made. *Second*, the diagnosis was correct in the first place (namely, negative) and the condition developed after entry into the service. I am unable to say which of the two possibilities applies, but will assume the first to be correct.

There is no doubt that this survey has been of value, not only to the Government but to the patient and contacts in his community. Eight hundred ninety seven (897) of the 400,263 men examined were discharged from the service with tuberculosis. For each case it was estimated that the Government has been saved at least twenty-five thousand dollars, a total of approximately $22,425,000. All of these cases have been placed under treatment, many of them will undoubtedly become quiescent or arrested, and with proper supervision spread of disease will be prevented.

In conclusion, I am of the opinion that the photofluorographic method of chest survey is inexpensive, reliable, and adequate. Of the two methods, that with 4 × 5-inch film is the better from the standpoint of reliability, as its accuracy very closely approximates the accuracy of the

REPORT OF PHOTOFLUOROGRAPHIC CHEST EXAMINATIONS AT U.S.N.T.S., GREAT LAKES, ILL.*

| | | Total | Per Cent |
|---|---|---|---|
| 1. | Number of 35-mm. films taken | 400,263 | |
| 2. | Number of check standard 14 × 7-in. films | 3,775 | 0.943 |
| 3. | Number rejected due to x-ray findings | 1,191 | 0.298 |
| | Tuberculosis | 897 | 0.2241 |
| | Other findings | 294 | 0.074 |
| 4. | Number of negative findings | 366,331 | 91.51 |
| 5. | Number of abnormal findings | 33,932 | 8.49 |
| 6. | Number of cases of pulmonary tuberculosis | 27,062 | 6.76 |
| | A-1 Active reinfection type | 432 | 0.106 |
| | A-2 Inactive reinfection type | 167 | 0.0417 |
| | B Active primary type | 6 | 0.0015 |
| | C-1 Inactive primary type of future importance | 54 | 0.0135 |
| | C-2 Inactive primary type | | |
| | (*a*) Healed primary complex | 8,806 | 2.199 |
| | (*b*) Calcified hilum nodes | 17,838 | 4.456 |
| | (*c*) Calcified tracheobronchial nodes | 168 | 0.0419 |
| | D-1 Multiple calcifications and massive calcification of hilum | 193 | 0.0482 |
| | D-2 Miliary calcifications in lung parenchyma | 246 | 0.0615 |
| | E Fibrinous and serofibrinous pleuritis | 79 | 0.0197 |
| 7. | Other diagnoses made whether cause for rejection or not (35-mm.) | | |
| | Cardiac enlargement and abnormal configuration | 2,169 | 0.542 |
| | Tortuous aorta | 27 | 0.0067 |
| | Dextrocardia | 62 | 0.0155 |
| | Prominent pulmonary conus | 314 | 0.0784 |
| | Atelectasis | 19 | 0.0047 |
| | Bronchiectasis | 26 | 0.0065 |
| | Pneumothorax (spontaneous) | 10 | 0.002498 |
| | Pneumoconiosis | 10 | 0.002498 |
| | Atypical pneumonia | 119 | 0.0297 |
| | Hemothorax | 1 | 0.0002498 |
| | Pulmonary abscess | 2 | 0.0004996 |
| | Emphysema | 3 | 0.00075 |
| | Thickened or calcified pleura | 51 | 0.0127 |
| | Azygos lobes | 411 | 0.103 |
| | Lung cyst | 2 | 0.0004996 |
| | Elevation of diaphragm | 96 | 0.024 |
| | Diaphragmatic adhesions | 174 | 0.0434 |
| | Tumor of diaphragm | 1 | 0.0002498 |
| | Eventration of diaphragm | 26 | 0.0065 |
| | Lung tumor | 4 | 0.00099 |
| | Mediastinal tumors | 38 | 0.0095 |
| | Substernal thyroid | 1 | 0.0002498 |
| | Pericardial adhesions | 3 | 0.00075 |
| | Fractured ribs | 28 | 0.00699 |
| | Anomalies of ribs | 1,715 | 0.4284 |
| | Cervical ribs | 238 | 0.0594 |
| | Rib tumors | 5 | 0.0013 |
| | Rib resection | 35 | 0.0087 |
| | Congenital absence of ribs | 1 | 0.0002498 |
| | Ununited fractured clavicle | 4 | 0.00099 |
| | United fractured clavicle | 19 | 0.0047 |
| | Metallic foreign body in thorax | 3 | 0.00075 |
| | Calcified cervical nodes | 5 | 0.0013 |
| | Foreign body in shoulder | 4 | 0.00099 |
| | Ununited epiphysis, scapula | 1 | 0.0002498 |
| | Congenital deformities of the spine | 8 | 0.0019 |
| | Thirteen thoracic vertebrae and 13 ribs (bilateral) | 1 | 0.0002498 |
| | Scoliosis (simple) | 1,142 | 0.285 |

| | | |
|---|---|---|
| Hypertrophic arthritis of spine | 4 | 0.00099 |
| Hemivertebrae | 25 | 0.00624 |
| Fractured vertebrae | 3 | 0.00075 |
| Spina bifida, thoracic and cervical | 6 | 0.0015 |
| Megacolon (from chest film, proved by abdominal film) | 5 | 0.0013 |

* Credit is given to Lieut. (jg) H. M. Weiselber, Lieut. Comdr. J. W. Jones Lieut. Comdr. M. A. Thomas, Lieut. Comdr. G. M. Picciochi, and Comdr. T. G. Clement, who examined some of these cases.

14 × 17-inch standard film method. But even though the accuracy of the 35-mm. method does not approach that attained with the larger films, it is adequate enough for practical purposes. At the present time surveys are being conducted in industrial plants and in some community public schools. These do not reach the entire population. It is not inconceivable, however, that a system can some day be devised through which the entire population of a given community can be surveyed, with the result that active cases can be so isolated and so supervised that eventually the incidence of tuberculosis will become insignificant.

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# EDITORIAL

Howard P. Doub, M.D., Editor

John D. Camp, M.D., Associate Editor

## The Joint Meeting

When it became necessary to cancel the 1943 meetings of the Radiological Society of North America and the American Roentgen Ray Society, the disappointment of the members was great. As the months passed, the realization grew that progress in radiology had been retarded by the cancellation of these customary gatherings. Therefore, after due consideration of the request of the Government that meetings having no bearing on the conduct of the war be postponed for the duration, the officers of the two societies decided, in view of the importance of radiology to the successful prosecution of our military activities, to hold a joint meeting in Chicago from Sept. 24 to Sept. 29, 1944. For this meeting, 1,382 members and guests turned out. All the states in the union were represented but one. There were 50 in attendance from Canada, and members and guests were registered from Mexico, Cuba, Puerto Rico, Brazil, and Chile. This splendid record is the best evidence that radiologists recognize the value of scientific meetings and unquestionably justifies the little extra strain that was placed upon transportation and hotel facilities.

Those who came were in no way disappointed. Every department of the meeting was outstanding. Eighty-three excellent papers were read: 51 on diagnostic subjects, 30 on therapeutic topics, and 2 on general non-scientific problems related to radiology. There were 42 scientific exhibits of a quality not one whit diminished by the handicaps of the extra pressure under which we are all working. The refresher courses, of which 28 were given, were magnificently prepared and presented. The popularity of these courses is justifiably on the increase. The 30 commercial exhibits showed the adherence to high standards that our manufacturers have in the past led us to expect.

At the opening session on Monday a warm welcome was given from the Chicago Medical Society by Josiah J. Moore, M.D., its President, and from the American Medical Association by its President, Herman L. Kretschmer, M.D. Doctor Kretschmer followed his remarks with a paper written in collaboration with Fay H. Squire, M.D., entitled "A Study of the Ureters in Bladder Neck Obstructions." This was followed by an address by Colonel B. R. Kirklin, representing Major-General Norman T. Kirk, Surgeon General of the U. S. Army, on "War Time Radiology and Peace Time Problems." The session was closed with a paper on "Pantopaque Myelography; Correlation of Roentgenological and Neurosurgical Findings," by Lt. Comdr. R. K. Arbuckle (representing Vice-Admiral Ross T. McIntire, Surgeon General of the U. S. Navy), Lt. C. H. Shelden, and Lt. R. H. Pudenz.

In the Diagnostic Section, Monday afternoon, six papers were presented: "Progressive Symmetrical Bullous Emphysema," George Teplick, M.D., and Allison Price, M.D.; "Non-Disabling Bronchiectasis," Major Archie Fine; "Roentgenograms of the Chest in Mental Deficiency," J. T. Danzer, M.D.; "Planigraphy: An Evaluation of the Method in the Diagnosis of Cancer of the Lower Respiratory Tract," J. R. Andrews, M.D., and Capt. R. O. Turek; "The Roentgenological Aspect of Tuberculous Calcification," R. G.

Bloch, M.D.; "Miniature Chest Fluorography with Control Study," Harry Hauser, M.D., and Carroll C. Dundon, M.D.

Six papers were also read in the Monday afternoon Therapy Section: "The Value of Orchiectomy in the Treatment of Carcinoma of the Male Breast," T. Leucutia, M.D.; "Testicular Irradiation in Carcinoma of the Prostate," A. D. Munger, M.D.; "An Improved Technic for the Treatment of Carcinoma of the Testis," Major Milton Friedman and Lt. Col. L. G. Lewis; "A Review of Sixty-five Cases of Malignant Tumors of the Testis," Major J. L. Barner; "Contact Roentgen Therapy for Carcinoma of the Bladder," L. S. Goin, M.D.; "Roentgen Therapy in Marie-Strümpell Spondylarthritis," R. J. Reeves, M.D., and J. E. Hemphill, M.D.

Tuesday morning opened with the installation of the President-Elect of the American Roentgen Ray Society, Lyell C. Kinney, M.D., who then read his Inaugural Address, filled with wisdom and deserving of careful perusal by every radiologist on its publication. Four papers completed the morning session: "The Roentgen Ray Examination of the Urinary Tract with Special Reference to Methods and Findings in Cases of Testicular Tumors," Lt. Col. J. C. Bell, Major G. W. Heublein, and Capt. H. J. Hammer; "X-Ray Findings in Chest Examinations of 120,000 Government Employees," Waldron Sennott, M.D., representing Thomas Parran, Surgeon General of the U. S. Public Health Service; "Radiation Necrosis of the Skull," Lt. Comdr. John D. Camp; "Coccidioides Infection of the Lungs," Lt. Col. J. D. Davis, Major I. H. Munk, and Capt. S. H. Boyer.

The papers in the Diagnostic Section, Tuesday afternoon, were: "Antral Gastritis: Roentgenologic and Gastroscopic Findings," W. W. Vaughan, M.D.; "Congenital Duodenal Obstruction," Ernest Kraft, M.D., F. G. Kautz, M.D., and J. R. Lisa, M.D.; "Diverticula of the Small Intestine," Max Ritvo, M.D., and P. J. Votta, M.D.; "Diaphragmatic Hernia and Dilated Esophageal Ampulla. Their Significance," Jacob Abowitz, M.D.; "Regional Ileitis," Samuel Brown, M.D.; and last, but far from least, "Differential Diagnosis Between Benign and Malignant Gastric Ulcers," Lewis Gregory Cole, M.D.

The Therapy Section on Tuesday was virtually a symposium on Leukemia, with the following papers: "Hematological and Clinical Characteristics of Leukemias," R. L. Haden, M.D.; "Clinical and Hematological Observations on One Hundred Patients with Various Types of Blood Dyscrasias Treated with Radioactive Phosphorus," E. H. Reinhard, M.D., and C. V. Moore, M.D.; "Leukemia: Results of Roentgen-Ray Treatment," B. P. Widmann, M.D.; "Experimental Production of Leukemia with X-Rays," P. S. Henshaw, Ph.D.; "Some Studies with Radioactive Sodium in Leukemic and Non-leukemic Mice," Edith H. Quimby, Sc.D., and T. C. Evans, Ph.D.

On Tuesday evening the memorial lectures of the two societies were combined into one Caldwell-Carman Lecture, "The History of the Use of the Roentgen Ray in Warfare," by Lawrence Reynolds, M.D. As a combined lecture, a double feature performance was expected, and it was delivered indeed, with distinction and interest. Our thanks go to Doctor Reynolds, and to those to whose judgment we owe his selection as the speaker.

The Wednesday morning assembly was opened by the Presidential Address of Eldwin R. Witwer, M.D., President of the Radiological Society of North America. This address, also, was packed with sage council for all radiologists. Organized radiology will be wise to heed the admonitions of its able leaders. Six papers completed the morning session: "Some Considerations Concerning the Roentgen Examination of the Head," E. P. Pendergrass, M.D., and C. R. Perryman, M.D.; "Radiological Aspects of Public Health Work," H. E. Hilleboe, M.D., and R. H. Morgan, M.D.; "Roentgen Changes Associated with Pancreatic Fibrosis," E. B. Neuhauser, M.D.; "Radioactive Sodium as a Tracer in the Study of Peripheral Vas-

cular Disease," B. C. Smith, M.D., and Edith H. Quimby, Sc.D.; "Streamlining X-Ray Therapy for War Time Service," Capt. Albert Soiland; "X-Ray Demonstration of Cecal Deformity in Amebiasis," Ross Golden, M.D., and P. H. Ducharme, M.D. The paper of Doctor Hilleboe and Doctor Morgan outlined the proposed objectives of the Public Health Service in regard to surveys for case finding in tuberculosis.

The Wednesday afternoon diagnostic papers were concerned wholly with bone and joint disease: "Differential Diagnosis of Tuberculosis in Joints of the Extremities," Raymond Lewis, M.D.; "Derangements of the Knee: The Diagnostic Scope of Soft Tissue Examination with the Vacuum Technic," Lt. Comdr. J. Gershon-Cohen; "Post-Traumatic Para-Articular Calcifications and/or Ossifications of the Ankle," Capt. A. D. Piatt; "Development of Bone Sarcoma Following Irradiation," C. H. Hatcher, M.D., "Lesions of the Intervertebral Disk in the Cervical Region," J. E. Whiteleather, M.D., R. E. Semmes, M.D., and Maj. Francis Murphey; "Roentgenologic Observations in Age Atrophy of the Spine," G. J. Marum, M.D.; "Deossifications Regional to Joints of Extremities," Col. A. A. de Lorimier, H. B. Boyd, M.D., and W. L. Minear, M.D.

The therapy papers presented on Wednesday afternoon were: "Roentgen Therapy for Brain Tumors," Percival Bailey, M.D., and T. J. Wachowski, M.D.; "Roentgen Therapy of Primary Neoplasms of the Brain and Brain Stem," A/Surgeon Comdr. C. B. Pierce, W. V. Cone, M.D., A. R. Elvidge, M.D., and J. C. Tye, Jr., M.D.; "Neurosurgical Treatment of Patients with Advanced Malignant Diseases," Gayle Crutchfield, M.D.; "Irradiation of Pituitary Tumors," W. S. Lawrence, M.D.; "Roentgen Therapy of Encephalitis," U. V. Portmann, M.D., and Roger Lough, M.D.; "Simplification of Tissue Dosage Estimation in X-Ray Therapy," Anna Hamann, M.D.

The general program Thursday morning included: "The Morgan X-Ray Exposure Meter and Phototimer," P. C. Hodges, M.D.; "Scout Film of the Abdomen," Lt. Col. Joseph Levitin; "Clinical Cineradiography—Brazilian Method," Dr. W. de Toledo Piza and Dr. José Jany, of São Paulo, Brazil; "Analysis of Factors Affecting the Diagnostic Quality of the Roentgen Image," R. H. Morgan, M.D.; "Importance of Recognizing Protrusions of the Gastric Mucosa in Military Personnel," Comdr. Wendell Scott; "Abdominal Aortography—A New Simplification of the Technic," Pedro L. Fariñas, M.D., of Habana.

The Thursday afternoon Section on Diagnosis offered: "The Roentgen Anatomy of the Skull in the Newborn Infant," S. G. Henderson, M.D., and Louise M. Sherman, M.D.; "Mid-line Anomalies of the Brain," A. P. Echternacht, M.D., and J. A. Campbell, M.D.; "Lesions of the Aqueduct of Sylvius," Hugh Wilson, M.D., and W. G. Lutz, M.D.; "Fibrous Dysplasia of the Bones of the Skull," D. G. Pugh, M.D.; "Observations on the Presence of Subdural Gas after Pneumoencephalography," L. W. Paul, M.D., and T. C. Erickson, M.D.

In the Therapy Section on Thursday were heard: "Results of Irradiation of Ovarian Tumors," H. D. Kerr, M.D., and R. A. J. Einstein, M.D.; "The Problem of Secondary Infection in Carcinoma of the Cervix," Manuel Garcia, M.D., and J. V. Schlosser, M.D.; "Irradiation Failures in Early Carcinoma of the Cervix—Is Surgery or Irradiation Preferable?" Franz Buschke, M.D., and S. T. Cantril, M.D.; "Indications and Limitations of Transvaginal Roentgen Therapy for Cancer of the Cervix," A. W. Erskine, M.D.; "Bone Tumors: Review of Cases from Bellevue Hospital, New York," Rieva Rosh, M.D., and Louis Raider, M.D.

Thursday evening we enjoyed a fine banquet, guided by Ed Jenkinson, as toastmaster, through an array of speeches and bows by the new officers of both societies. The speaker of the evening was Franklyn B. Snyder, Ph.D., President of

Northwestern University. His address was one of the finest we have had the privilege of hearing. His theme, illustrated by an incident from early American history, was that ignorance of nature and of human relations is the basis of most of the troubles of the individual and of society. The recognition of these two weaknesses points the way to a solution of many of our pressing problems.

The last morning session, Friday, included: "Osteochondritis Dissecans of the Supratrochlear Septum of the Humerus," A/Surgeon Lt. Comdr. W. E. Crysler and Surgeon-Comdr. H. S. Morton; "Subcortical Cyst-like Lesions of Joints," D. B. Phemister, M.D.; "Cardiac Changes in Arteriovenous Fistula," Maj. R. C. Pendergrass; "Cystourethrography," F. O. Coe, M.D.; "Roentgenologic Aspects of Therapeutic Pneumoperitoneum," E. A. Schmidt, M.D.; "Topical Anesthesia in Gastrointestinal Spasm, a Diagnostic Aid." L. A. Smith, M.D.

The final Diagnostic Section presented: "Roentgen Appearances in Collapse of the Lung and Its Subdivisions: A Preliminary Report," L. L. Robbins, M.D., and C. H. Hale, M.D.; "Gas Gangrene," Capt. M. D. Sachs; "Extra-Pleural Pneumothorax in the Treatment of Pulmonary Tuberculosis: Three to Five Year Follow Up of 48 Cases," F. H. Alley, M.D.; "Some Experiences with Angiography," E. A. Miller, M.D.; "Specifications for the Fluoroscopist's Dark Adaptation Goggles," W. E. Chamberlain, M.D., and Ann Chamberlain; "Unusual Urinary Calculi," E. J. Bertin, M.D.

The closing Therapy Session offered: "The Treatment of Hemangiomas," G. E. Pfahler, M.D.; "Treatment of Hemangioma with Roentgen Rays," J. V. Prouty, M.D.; "Cancer of the Skin," H. J. Ullmann, M.D.; "Post-irradiation Cutaneous Necrosis," H. B. Hunt, M.D., and D. H. Breit, M.D.; "The Radon Ointment Treatment of Irradiation Ulcers," R. E. Fricke, M.D., and M. M. D. Williams, Ph.D.; "Evaluation of Roentgen Therapy for Filariasis," Lt. H. L. Jaffe.

The smoothness with which everything moved and the enthusiasm of those in attendance are a tribute to the hard work that was done by the Coordinating Committee, Doctor Jenkinson, Doctor Kinney, Doctor Portmann, and Doctor Witwer, its Chairman. To them and to all who contributed to this successful meeting go our heartfelt thanks and appreciation.

S. J. HAWLEY, M.D.

## The Scientific Exhibits

In spite of the heavy demands on the radiologist in a nation at war, more than eighty exhibitors were represented in the scientific exhibits at the Joint Meeting of the two radiological societies. The exhibits are listed below:

WILLIAM S. ALTMAN, M.D., AND HARRY F. FRIEDMAN, M.D. (*Boston, Mass.*): Treatment of Superficial Hemangioma with Contact Therapy. Dr. Altman and Dr. Friedman used kodachrome slides showing superficial hemangiomata before and after application of contact therapy. The kodachromes were of small and extensive lesions and were of excellent quality, graphically demonstrating the color changes obtained by this method of treatment.

MELVIN ASPRAY, M.D. (*Spokane, Wash.*): Hemangiomata of the Liver. With a few 14 × 17″ films made in one case, Dr. Aspray called attention to a rare sunburst type of calcification in the liver which is typical of hemangiomata of that organ and is comparable to a similar finding in hemangiomata in skulls, as pointed out by Bucy and Capp.

E. C. BAKER, M.D., S. H. SEDWITZ, M.D., AND F. A. MILLER, M.D. (*Youngstown, Ohio*): Venographic Patterns of the Lower Extremities. Normal and abnormal venographic patterns were demonstrated

by meticulous drawings accompanying the original films. Several examples of thrombosis and methods of abnormal return of blood from thigh to body were shown by Dr. Baker and his associates.

C. C. BIRKELO, M.D., AND WILLIAM BROSIUS, M.D. (*Detroit, Michigan*): Postmortem Roentgenograms of the Lung. Using the original 14 × 17″ films, Drs. Birkelo and Brosius demonstrated roentgenographic findings in various types of pulmonary diseases and, with accompanying roentgenograms made after necropsy, showed the lungs in these cases inflated to antemortem volume. They thus made a comparative study frequently clarifying obscure roentgen findings.

HAROLD B. BOYD, M.D., W. L. MINEAR, M.D., AND COL. A. A. DE LORIMIER, M.C. (*The Willis C. Campbell Orthopedic Clinic, Memphis, Tenn.*): Deossifications Regional to Joints of the Extremities. This exhibit represented a study of more than 200 cases of deossification in extremities. An attempt was directed toward identifying etiological factors related to the several types of deossification. The changes were found secondary to trauma, following infections, and associated with neoplasms and prolonged disuse.

SAMUEL BROWN, M.D. (*Cincinnati, Ohio*): Case Reports. A miscellaneous group of unusual and interesting cases was demonstrated, in which the diagnosis was determined largely by roentgenographic methods.

FRED O. COE, M.D., AND P. S. ARTHUR, M.D. (*Washington, D. C.*): Cysto-Urethrography in Diagnosis of Prostatic Disease. A technic of graphic demonstration of normal and pathological conditions in bladder and urethra was illustrated in a series of thirty 10 × 12″ reduction films. The pathological conditions were largely those of the prostate affecting the bladder and urethra.

LEWIS GREGORY COLE, M.D. (*White Plains, N. Y.*): Pathogenesis versus Cytology in the Differentiation of Ulcers from Cancer. This exhibit represented a method of microscopic diagnosis of ulcerating gastric neoplasm based on pathogenesis or the mode of development of the lesion, regardless of the cytological characteristics of the cells. Twenty-five microscopic criteria of neoplasm were observed that were direct antitheses of those observed in simple inflammatory ulcers.

COL. A. A. DE LORIMIER, M.C., A.U.S. (*The Army School of Roentgenology, Memphis, Tenn.*): The Layout of the Army School of Roentgenology. Photographic views of the medical center, the school building, and a variety of views pertinent to training activities were shown in an interesting and instructive collection.

COL. A. A. DE LORIMIER, M.C., A.U.S., AND CAPT. C. A. HALLIN, M.C., A.U.S. (*The Army School of Roentgenology, Memphis, Tenn.*): Auxiliaries for the U. S. Army Field Table Units. The regular field table of the Army was shown with an x-ray machine unit and the auxiliary attachments mounted. With this were shown a small motor mechanism, a serialographic attachment, and a new bi-plane marker.

LILIAN DONALDSON, M.D., AND SYLVIA BENSLEY, M.D. (*University of Chicago, Chicago, Ill.*): An X-Ray Museum for the Teaching of Medical Students. This exhibit was a demonstration of the methods used in the University of Chicago, Department of Medicine, Division of Roentgenology, for the teaching of anatomy and clinical medicine, including radiology.

PEDRO L. FARIÑAS, M.D. (*Habana, Cuba*): Abdominal Aortography: A New Simplification of the Technic. A most interesting collection of roentgenograms was shown, illustrating different pathological conditions of the abdominal aorta and its main branches. There was a photograph of the instruments used in the procedure, and a chart giving a brief description of the method was shown.

LIEUT. COL. EUGENE FREEDMAN, M.C., A.U.S., CAPT. S. MESCHAN, M.C., A.U.S., AND LESLIE LOVE, M.D. (*Dibble General Hospital, Menlo Park, Calif.*): Hydatid Cysts. An excellent collection of films from several hospitals in Australia was

shown, demonstrating the radiologic appearance of hydatid cysts in the lungs, pleura, pericardium, liver, spleen, mesentery, kidneys, and various bones.

MAJOR MILTON FRIEDMAN, M.C., A.U.S., AND LIEUT. COL. LLOYD LEWIS, M.C., A.U.S. (*Walter Reed General Hospital, Washington, D. C.*): Improved Technic for the Treatment of Carcinoma of the Testis. In this exhibit an excellent group of charts, diagrams, color photomicrographs and color photographs was used to illustrate the following factors: (1) study of the lethal tumor dose based on histologic examination of tumors exposed to various quantities of radiation; (2) operative investigation of the distribution of retroperitoneal nodes in relation to the size and duration of the primary tumor; (3) the precise technic of irradiation, including location of the portals and determination of the exact tumor dose to retroperitoneal nodes at different levels.

LOWELL S. GOIN, M.D. (*Los Angeles, Calif.*): Combined Surgical and Radiation Therapy in Cancer of the Bladder. This exhibit was in the form of a 16-mm. kodachrome movie film depicting a method used by Dr. Goin in treating with low-voltage contact therapy certain bladder tumors. Careful selection of cases as to size and location of the tumor preceded the surgical exposure and removal of most of the growth by electrocoagulation. The base of the tumor was then irradiated by direct contact on one or two occasions. Thirty-one patients were treated. Of these, 27 per cent are reported living, either with or without cancer.

JEAN A. GROH, M.D. (*Cleveland, Ohio*): The Arc-Welder's Lung. A series of twelve chest films was shown depicting the typical findings in a chest survey of 83 arc welders in one industrial firm. A peculiar soft mottling was present in the films of 71 per cent of these workers and, on the basis of previous work by other investigators, was interpreted as iron oxide staining. The importance of recognizing the condition as harmless and differentiating it from other similar findings was stressed.

LIEUT. COL. JOHN B. HAMILTON, M.C., A.U.S., MAJOR JOHN L. BARNER, M.C., A.U.S., AND CAPT. PUTNAM C. KENNEDY, M.C., A.U.S. (*An Army General Hospital, Atlanta, Ga.*): Interesting Bone Lesions. This was a very interesting and instructive collection of films showing various bone lesions encountered in the roentgenological service of a military general hospital. The lesions were classified in four groups: tumors, infections, systemic conditions, and a miscellaneous group.

HARRY HAUSER, M.D., AND C. C. DUNDON, M.D. (*Cleveland, Ohio*): Miniature Chest Fluorography with Control Study. This exhibit demonstrated in a graphic manner the value of stereoscopic $4 \times 5''$ miniature fluorographs in a control study of one thousand apparently healthy adult chests, utilizing both conventional and miniature methods in each case.

SAMUEL G. HENDERSON, M.D., AND LOUISE S. SHERMAN, M.D. (*Pittsburgh, Penna.*): The Roentgen Anatomy of the Skull in the Newborn Infant. A very fine series of sixty films was shown, demonstrating the anatomy of the skull of the newborn infant, together with certain normal variations of the common pattern of the bony structures. *Honorable mention was awarded this exhibit.*

PAUL S. HENSHAW, M.D. (*Bethesda, Md.*): Radio-Leukemia. Experimental induction of leukemia in mice with x-rays was shown in a striking manner in this exhibit. It was a pictorial demonstration, showing how the incidence of leukemia varies with the dose of the radiation applied, and something of the hematologic and histologic changes that occur preceding the full-blown disease. Material was also presented showing the incidence of leukemia in physicians, the relationship of radiation as a carcinogenic agent to other carcinogens, and the amount of ionization produced in tissues by a certain exposure. *This exhibit received the Third Award.*

J. F. HOLT, M.D., AND FRED JENNER HODGES, M.D. (*Ann Arbor, Mich.*): Bones of the Hands, An Index of Local and Systemic Disease. This was a well-planned

and instructive exhibit demonstrating about twenty-six diseases or systemic conditions which produce roentgenological evidence in bones of the hands.

JOSÉ JANY, M.D., JOAQUIN MARTINS GARCIA, M.D., AND CAPT. FRANCO (*São Paulo, Brazil*): Clinical Cineradiography: Brazilian Method. An interesting short movie demonstrated a method of cineradiography employed in Brazil. Several excellent cineradiographic films were shown.

WAYNE A. JOHNSTON, M.D., AND JULIUS HEYDEMANN, M.D. (*Dubuque, Iowa*): Pulmonary Mycosis. This exhibit showed pulmonary mycosis found and diagnosed in a town of the Middle West. It demonstrated the similarity of the roentgen findings in all of the cases and showed that these are quite informative, although not diagnostic in themselves.

CARL LIST, M.D., CURTIS BURGE, M.D., AND FRED JENNER HODGES, M.D. (*Ann Arbor, Mich*).: Cerebral Angiography. An excellent collection of films showing various lesions depicted by intracranial angiography was presented in this exhibit. Examples of angiograms illustrating stereoscopic film pairs made during the arterial and venous phases of circulation were shown. Combined arteriograms and ventriculograms graphically demonstrated certain intracranial derangements.

EDWARD E. MANSUR, M.D. (*Jefferson City, Mo.*): Anatomical Relationship of the Ureters to the Cervix and Uterus in the Female Pelvis as Shown by Film Negatives. This exhibit, utilizing a few films, demonstrated very clearly the relationship of the ureters to the cervix and uterus in the female pelvis.

EARL R. MILLER, M.D. (*San Francisco, Calif.*): Angiography. This was a very informative collection of films depicting opacification of vessels for demonstration of necrosis, cardiac and arterial anomalies and diseases. Demonstration of peripheral circulation by these methods called attention to the possibility of diagnosing many lesions in the periphery of the body by this method.

RUSSELL H. MORGAN, M.D., AND ENSIGN HARRY LONG, U.S.N. (*U. S. Public Health Service and Medical Department, U.S.N., Washington, D. C.*): Automatic Methods for Photofluorography. This exhibit showed a 35-mm. photofluorograph equipped with an automatic photo-electric timing mechanism (phototimer) and an automatic 35-mm. camera. The operation is spectacularly simple, requiring only the proper centering of the subject and the closure of the exposure switch. The phototimer terminates the exposure at the instant the film has received the correct quantity of radiation to insure optimal diagnostic quality, and on the completion of the exposure the camera automatically moves the film to the next frame, preparing the photofluorograph for the next exposure. The phototimer was designed and developed with the co-operation of the Office of Scientific Research and Development in the Division of Roentgenology, University of Chicago. The automatic camera was designed and developed at the U. S. Naval Medical Center, Bethesda, Md.

SURGEON COMMANDER H. S. MORTON, AND A/SURGEON LIEUT. COMMANDER W.E. CRYSLER (*Royal Canadian Navy, Ottawa, Canada*): Osteochondritis Dissecans of the Supratrochlear Septum (Humeri). The roentgenologic features of osteochondritis dissecans of the supratrochlear septum of the humerus were demonstrated in reproductions of films and photomicrographs from six cases. The roentgenographic findings were those of a separate ossicle of bone arising from the supratrochlear septum in various degrees of sequestration.

A/SURGEON COMMANDER C. B. PEIRCE, A/SURGEON LIEUT. COMDRS. BOUCHARD, MCRAE AND VAUGHAN, SURGEON-LIEUTENANTS BROOKE, GREENE, AND STAPLETON (*Royal Canadian Navy, Ottawa, Canada*): Arthrography of the Knee. This very fine exhibit of arthrographs demonstrated various derangements and lesions of the knee joint, especially as affecting the semilunar cartilages. The methods employed in the several Royal Canadian Naval

Hospitals were shown with their resultant roentgenograms. *This exhibit received Honorable Mention.*

EUGENE P. PENDERGRASS, M.D., JOHN Q. GRIFFITH, JR., M.D., NICHOLAS PADIS, M.D., AND ROBERT P. BARDEN, M.D. (*Philadelphia, Penna.*): Pituitary Irradiation Controlled by Biologic Tests. By means of charts, photographs, and drawings, the exhibitors illustrated their experiences with pituitary irradiation in 142 cases of arterial hypertension. They demonstrated (1) a method of bioassay for certain pituitary hormones, particularly the antidiuretic hormone; (2) the effect of pituitary irradiation in the development of such hormones; (3) effect of irradiation on the pituitary in arterial hypertension cases which are selected on the basis of hormonal bioassays; (4) the effect of irradiation on adjacent brain tissue. *This exhibit received First Award.*

LIEUT. COL. ROBERT C. PENDERGRASS, M.C., A.U.S. (*Ashford General Hospital, White Sulphur Springs, West Va.*): Cardiac Changes in Arteriovenous Fistula. This was an informative and nicely planned exhibit demonstrating changes in cardiac size with arteriovenous fistula, with a comparison of heart size before and after surgical closure of the fistula. Gradual development of cardiac enlargement following war wounds producing arteriovenous fistulae was demonstrated. The effect of compression of the fistula on the heart was illustrated.

ERNST A. POHLE, M.D., L. W. PAUL, M.D., AND E. A. CLARK, M.D. (*Madison, Wis*).: Roentgen Therapy of Boeck's Sarcoid. Selected films from a series of fifteen cases of Boeck's sarcoid treated with roentgen rays were shown. Irradiation in doses comparable to those commonly used in treatment of inflammatory disease was employed, with apparent beneficial results in some patients.

CAPT. HUBERT J. PRICHARD, M.C., A.U.S., CAPT. RICHARD E. KINZER, M.C., A.U.S., AND CAPTAIN MEDLIN, M.C., A.U.S. (*Washington, D. C.*): Chest Pathology Encountered at Induction Stations. This was an informative and interesting exhibit of the latest photoroentgen equipment used by the U. S. Army at induction stations, together with an extensive collection of films depicting the varied chest lesions encountered at these stations. Both regulation stereoscopic 14 × 17″ films and 4 × 10″ films of the same case were demonstrated, showing the remarkable constancy of the latter in exhibiting the same details as the regulation 14 × 17″ stereoscopic studies.

LAWRENCE REYNOLDS, M.D., AND ASSOCIATES (*Harper Hospital, Detroit, Mich.*): Roentgen Demonstration of the Semilunar Cartilage of the Knee Joint and of Injuries to This Cartilage. Charts, photographs, and films were used to illustrate in an excellent manner a method of demonstrating roentgenographically normal and abnormal medial menisci of the knee joint. The technic of this examination in the hands of the authors appears fairly simple and affords an excellent method of demonstrating disorders involving the semilunar cartilage.

LEO G. RIGLER, M.D., HENRY S. KAPLAN, M.D., AND CAPT. DANIEL L. FINK, M.C., A.U.S. (*Minneapolis, Minn.*): Tumors of the Stomach and Pernicious Anemia. A splendid series of films was shown illustrating the relationship of benign to malignant tumors of the stomach and their association with pernicious anemia. Routine semiannual roentgen examination of the stomach in patients with pernicious anemia and material from a large autopsy series in pernicious anemia cases would seem to confirm the opinion that there is a far greater incidence of gastric tumors in patients with pernicious anemia than in the remainder of the population.

LAWRENCE L. ROBBINS, M.D., AND CLAYTON H. HALE, M.D. (*Boston, Mass.*): Roentgen Appearance in Collapse of the Lung and Its Subdivisions. This exhibit was an excellent demonstration of the diagnostic points in recognizing collapse of the lung and its subdivisions by means of various roentgenograms. The films shown were representative of a detailed

study of 900 chest examinations in which there was some evidence suggesting collapse of one or more lobes or segments of lobes of the lung. *Second Award was given this exhibit.*

CAPT. ALBERT SOILAND, M.C., U.S.N.R., WM. E. COSTOLOW, M.D., AND ORVILLE N. MELAND, M.D. (*Los Angeles, Calif.*): Third Dimensional Roentgenographic Studies of Soft Tissue. This exhibit portrayed a method of producing soft-tissue roentgenograms having depth perception. The method is advocated as a substitute for single flat films when the parts to be examined are subject to involuntary motion. Two films placed in a special cassette are exposed simultaneously to produce stereoscopic vision.

ROBERT B. TAFT, M.D. (*Charleston, S. C.*): Radium Contamination of Film Boxes. This was a most interesting and informative exhibit, tracing certain black spots in films after development to the effect of tiny bits of radioactive material in the pasteboard of the film box. The source of these radioactive substances was found to be waste paper on which paint brushes carrying forms of luminous paint had been cleaned. *Honorable Mention was given to this exhibit.*

HENRY K. TAYLOR, M.D. (*New York, N. Y.*): Aseptic Necrosis in Adults. This splendid exhibit displayed many examples of the roentgenographic evidence of bone infarcts and areas of aseptic necrosis occurring in fourteen caisson and thirty-five non-caisson workers. The lesions in both groups present roentgenographic appearances which are similar and at times cannot be differentiated one from the other.

H. S. VAN ORDSTRAND, M.D., ROBERT HUGHES, M.D., J. M. DENARDI, M.D., AND MORRIS G. CARMODY, M.D. (*Cleveland, Ohio*): Poisoning in Beryllium Production. This was an excellent exhibit demonstrating the clinical and pathological findings in workers processing beryllium from the raw ore. Respiratory, dermatological, and ocular manifestations were shown. A chemical pneumonitis was demonstrated in many cases and autopsy material from four fatal cases was studied.

MARY FRANCES VASTINE, M.D., EDWIN L. LAME, M.D., FRANK S. CLARKE, M.D., AND LAURENCE B. RENTSCHLER, M.D. (prepared under direction of EUGENE P. PENDERGRASS, M.D., AND JACOB H. VASTINE, 2ND, M.D., *Philadelphia, Pa.*): The Hip Joint—Roentgenologic Aspects of Pathology in This Region. This was a very inclusive and instructive exhibit of the roentgenographic evidence of varying conditions which can affect the hip joint.

FRANK WINDHOLZ, M.D. (*San Francisco, Calif.*): Tissue Changes in the Cancerous Larynx After Protracted and Fractionated Irradiation. In this exhibit photomicrographs were shown illustrating tissue reactions in ten larynges at different times after irradiation. The histology of the fibrinous reaction, healing of the tumor, perichondritis, changes in the epithelial, connective and muscle tissues were shown.

CLARENCE E. HUFFORD, M.D.

## The Commercial Exhibits

As a result of the splendid co-operation of thirty exhibitors, the space reserved for commercial exhibits at the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America was filled almost to overflowing. The exhibit space was adjacent to the scientific exhibits, and it was necessary to pass through it to reach the ballroom, where the morning sessions and the afternoon diagnostic sessions were held. The attendance at the commercial exhibits was excellent, giving the exhibitors an opportunity to demonstrate new equipment and methods, to renew old friendships, and to make new contacts with the more than 1,300 members and guests registered at the meeting.

Your roving reporter (Chairman of the Commercial Exhibit Committee) attempted to make notes on all the exhibits, but the material was so extensive that it was impossible not to miss some points of interest. To appreciate the quality and extent of the exhibits, it is necessary to see them for oneself. Not to spend considerable time in the commercial exhibit section is to miss an important part of our scientific meetings.

Many of the exhibitors have been producing materials of great value to the war effort, which for reasons of security they could not show, but the quality of the equipment displayed was up to pre-war standards, and the extent of the exhibits indicated that the difficulties in the shipping situation, which interfered with the size and quality of the exhibit at the 1942 meeting, had been largely overcome.

A brief note concerning each of the exhibits follows:

*Ansco:* In addition to the excellent line of photographic materials shown by Ansco, there were also exhibited specimens of the machine work turned out in their shops for the ordnance departments of our Armed Forces.

*Buck X-ograph Company* demonstrated complete film processing tank layouts, with thermostatic controls. A new development, shown in the central portion of their exhibit space, was an ingenious wet film transfer cabinet for viewing wet films. Mr. Buck was in immediate charge of the exhibit.

*Canadian Radium & Uranium Corporation:* This exhibit demonstrated radium and its applications from the ore to the finished product. Of especial interest was the radon-containing ointment which is being used in the treatment of radiation injuries and other intractable conditions.

*E. I. du Pont de Nemours & Co., Inc.:* An extensive exhibit of du Pont products, of which there is an extremely varied assortment, was shown. A large spindle of Nylon thread brought forth many expressions of interest, especially from the lady visitors. Carl Patterson (Patterson Screens), an important addition to the du Pont Company, was on hand.

*Eastman Kodak Company:* The use of "Kodacolor aero reversal film" in aerial photography was strikingly demonstrated by a long strip color photograph shown in a special demonstration at the front of the booth. Films and chemicals for various purposes were shown, and it seemed like old times to have a few new Kodaks for the photographic fans to examine.

*Eureka X-Ray Tube Corporation:* This well-known manufacturer showed a complete line of tubes for all types of x-ray work. Cross-section samples to show ruggedness of construction made it plain why the tubes manufactured by this company have gained an enviable reputation.

*General Electric X-Ray Corporation:* An excellent showing of the G. E. line of x-ray equipment required one of the largest exhibit spaces on the floor. Many types of diagnostic and therapeutic equipment were displayed. One item which received much attention was the recently developed dictating and repeating instrument, about the size of a portable radio receiver, which "takes down" either words or music with equal ease by magnetizing a rapidly moving fine wire, and then, on the turn of a switch, "repeats it back to you." The future doubtless holds many uses for this invention.

*Kelley-Koett Manufacturing Co.:* Another large exhibit space was used by Kelley-Koett for the display of equipment and supplies. Items such as a high-voltage therapy machine, Bucky motor-drive tilt tables, diagnostic generators and controls, and accessories showed that this company has allowed no relaxation of the high standards of quality which it has maintained for years.

*Lea & Febiger,* publishers, exhibited a selected display of their publications which proved of considerable interest to the physicians attending the convention. Even a partial list of the books exhibited would be too long to include here, but Dyke and Davidoff's "Roentgen Treatment of Dis-

eases of the Nervous System" and the second edition of Master's "The Electrocardiogram and X-ray Configuration of the Heart" were frequently examined by the visitors. Over fifty other works were exhibited by Mr. L. E. Drury.

*Liebel-Flarsheim Co.:* The Bucky diaphragms and grids which this company constructs for many x-ray equipment manufacturers are well known to all radiologists, and were well explained at its booth.

*Machlett Laboratories:* This exhibit included the introduction to the public of a new hermetically sealed, precision type 2,000,000-volt x-ray tube, of relatively small size considering its capacity, and a wonderful example of engineering and construction. It has a $^{1}/_{100}$" focal spot, providing for the first time a practical supervoltage x-ray tube for radiography of heavy objects and for therapy. Special tubes with beryllium windows, as well as Machlett rotating and stationary anode tubes, of a quality well known to all radiologists, were also displayed.

*F. Mattern Manufacturing Co.* exhibited its line of up-to-date diagnostic x-ray equipment. Though this company is something of a newcomer in the x-ray field, its products have had a good reception. It featured automatic controls and safety devices to prevent overloading of circuits. The number of visitors to the exhibit indicated the interest in these products.

*The Medical Bureau* was efficiently handled by Miss Burneice Larson and her co-operative assistants. Inquiries for professional assistants and technical employees were handled and placement of those searching for opportunities was furthered. Those attending this type of meeting have found it to their advantage to be able to discuss such matters directly rather than by mail.

*National Synthetics:* Products for the visualization of the gallbladder were featured in this exhibit. Both intravenous and oral dye preparations, in various dispensing units, tablets, and powders were shown. The use of the new preparation "Dikol" and the gallbladder stimulant "Cholex" was promoted by a special offer on quantity purchases during the meeting. Of special interest was a series of films demonstrating results of a new opaque medium for oral administration, still unmarketed, which showed possibilities for demonstration of the genito-urinary system with simultaneous gallbladder visualization within six hours.

*Newman X-Ray Corporation,* a new exhibitor at our meetings, showed a wide line of diagnostic x-ray equipment. The statement that none of their equipment is based on prewar engineering seemed warranted by its up-to-date appearance and operation.

*North American Philips Co., Inc.:* The feature of this exhibit was the apparatus for contact and cavity therapy. This type of equipment has recently been coming into use, for the treatment of many accessible lesions, to quite an extent, and the exhibit attracted much interest.

*Pako Corporation:* A completely automatic processing setup which will turn out a finished film every minute, as long as the feeding device is kept loaded with exposed films, was an interesting exhibit demonstrated in motion. It would seem that this equipment might be the answer for a busy darkroom where several technicians are required but are not available under present conditions.

*Picker X-Ray Corporation:* Presided over by the genial Mr. Picker himself, the Picker exhibit attracted many visitors. An extensive showing of equipment and supplies, from their smaller machines up to the heavy duty diagnostic equipment with their well known "Monitor" controls, was made.

*Powers X-Ray Products Co.,* manufacturers and distributors of sensitized paper, announced the availability of "Powers x-ray paper" to the medical profession at approximately one-half the cost of celluloid.

*Radiology:* A booth was used to introduce our well known journal to those not yet acquainted with it. Presided over ably

by representatives of the editorial staff, it was a very definite attraction. A booklet of "Instructions to Authors," containing much useful information on the preparation of illustrations, was a popular feature.

*Radium Chemical Company:* An extensive exhibit of instruments and applicators for the use of radium was shown. A new type of plastic applicator may well prove to be of considerable importance.

*Schering Corporation:* The space occupied by this corporation was used to demonstrate many products of interest to the medical profession. Hormones of various types were shown. Of especial interest to radiologists was Neo-Iopax for intravenous urography and the new Priodax for cholecystography.

*Sola Electric Co.*, manufacturers of constant voltage transformers, brought their products directly to the attention of the radiologists at this meeting. These transformers are built to deliver an even flow of current to the machine with which they are used. The use of constant voltage transformers in x-ray equipment should prove to be of considerable value in the future.

*Standard X-Ray Co.* demonstrated an extensive line of x-ray equipment. Prominently displayed were the shock-proof model F-30 mobile and portable unit and the model F radiographic and fluoroscopic tilting table.

*Charles C Thomas*, publisher, had on exhibit his latest books. Many were of special interest to those attending this meeting—to mention only two: Pancoast, Pendergrass and Schaeffer: "The Head and Neck in Roentgen Diagnosis"; Donaldson: "The Roentgenologist in Court."

*Victoreen Instrument Co.* demonstrated their well-known x-ray measuring instruments. The Condenser R-Meter, the 120 Iometer, and the Integron III all help to insure the application of a safe quantity of x-radiation to a patient.

*Westinghouse Electric and Manufacturing Co.* required one of the largest of the exhibit spaces to demonstrate their products. Of especial interest were the Photo-Fluorographic Camera, the Photo-timer constructed on the Morgan-Hodges principle, and a new series of dental units. A view box bank at 120° was a change from standard procedure.

*Winthrop Chemical Co.* exhibited Diodrast, Skiodan, and other pharmaceutical products used by the radiologist. Excellent instructive brochures on "Excretion Urography and Retrograde Pylography" were available. Much interest was manifested in the new 70 per cent Diodrast solution, as used for angiography.

*Wolf X-Ray Products, Inc.:* An excellent showing of accessories of many types was made by this company. Protective gloves for use in fluoroscopy, opaque materials, filing equipment, and many other items were attractively displayed.

*Year Book Publishers:* The "Handbooks of Roentgen Diagnosis" and "Medical Physics" shared top interest at this exhibit. Unique in the literature, the Handbooks are actually x-ray atlases of convenient size, designed to provide the most direct possible presentation of the specific roentgen criteria pointing to correct diagnosis. "Medical Physics," edited by Dr. Otto Glasser, presents vital information in an understandable way.

The above notes are offered in a feeble attempt to tell those who failed to see the exhibits a little about what they missed, so that they will not fall into the same error at the next meeting.

With full knowledge that I have probably left unsaid the things which should have been said about many of the exhibits, and with apologies in advance for so doing, but with deep appreciation of the excellent exhibits and the co-operative exhibitors, this is respectfully submitted.

W. R. SCOTT, M.D.,
*Chairman, Commercial Exhibits Committee*

# The Refresher Courses

Reservations prior to and registrations during the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America resulted in a grand total of 854 applicants for the Refresher Courses. Included in this group were registrants from 47 states and the District of Columbia, from Brazil, Canada, Chile, Cuba, Mexico, Peru, and Puerto Rico, truly a grand representation of both Americas. A large proportion of attendants at the Courses were members of one or both of the participating societies, many were members of the Armed Services, and many others attended as non-member, paying guests.

The excellent attendance at all the Courses speaks highly for this type of program and for the high caliber and exceptional talent of the members of the faculty. The three panels presented Sunday afternoon were faced with capacity crowds, 200 each for the course on Neurological Lesions and the Physics program, and 400 for Diseases of the Esophagus, Stomach and Duodenum. Sunday evening, 200 (capacity) attended the Panel on Carcinoma of the Breast, while a tremendous turnout of nearly 600 attended the Film Reading Session. All of these courses were well given and equally well received. We have heard nothing but praise for the program, thanks to all who participated and particularly to Drs. Fay Squire, T. J. Wachowski, R. S. Landauer, T. Leucutia, M. C. Sosman, Ross Golden, and E. P. Pendergrass for their part in the arrangements. The very excellent Film Reading Session would not have been possible without the University of Pennsylvania film projector. This instrument permitted film presentations that could be clearly seen throughout the Red Lacquer Room. The Committee is deeply indebted to Gene Pendergrass for its use.

A completely filled program of five courses was presented each morning, Monday through Friday, making, with the Sunday Panels, a total of 28 courses. It would be impossible to say that any one course was better received than any other, since every audience was enthusiastic. The largest week-day attendance recorded was for the Gastro-Intestinal series, all of which were held in the Grand Ball Room. These were given as follows, Gallbladder and Pancreas, B. R. Kirklin, M.D., Duodenal Lesions, F. E. Templeton, M.D., Small Intestine, Ross Golden, M.D., Colon, Harry M. Weber, M.D., Acute Abdominal Disorders, Leo G. Rigler, M.D.

Chest pathology was well covered, with courses in the Pneumonias, with L. R. Sante, M.D., Lesser Circulation, W. Walter Wasson, M.D., Mediastinum, L. W. Paul, M.D., and Tuberculosis, C. C. Birkelo, M.D. A two-day course of exceptional merit—"Four Rare Diseases: Clinical, Pathological and Roentgenological Aspects (Acute Disseminated Lupus; Periarteritis Nodosa; Erythema Nodosum; Sarcoidosis)—was presented by M. C. Sosman, M.D., Howard Armstrong, M.D., and Orville Bailey, M.D.

Problems in Therapy and Physics were next in line; the faculty was well pleased and the attendants were most complimentary. These courses began with Practical Problems in Dosage Measurement by Edith H. Quimby, Sc.D., followed by Radium Physics, K. E. Corrigan, Ph.D.; Electronics in Radiology, Otto Glasser, Ph.D.; Roentgen Therapy for Infectious Processes, W. C. Popp, M.D., Biologic Reactions of Tissue to Radiation, Maj. M. Friedman, Radiotherapy of Hodgkin's Disease and Lymphosarcoma, Maurice Lenz, M.D., and Carcinoma of the Uterus with H. E. Schmitz, M.D., and J. F. Sheehan, M.D. The only regrets on these courses came about through the unavoidable overlapping of some of them, thus limiting selections to one a day.

The Roentgenology of the Urinary Tract, another two-day course, was well covered by E. P. Pendergrass, M.D., G. W.

Chamberlin, M.D., and P. Boland Hughes, M.D., a group of about 275 attending each session. In addition to radiologists, a number of genito-urinary surgeons registered for this course, and all were well pleased.

Courses on other subjects included Pelvimetry by Fred O. Coe, M.D.; Diaphragmatic Hiatus Hernia, Max Ritvo, M.D.; Roentgen Differentiation of Abdominal Tumors, Samuel Brown, M.D.; Low Back Pain, H. E. Potter, M.D.; Gynecography, R. A. Arens, M.D., and I. F. Stein, M.D., completing a well-rounded program.

The attendance at some of the courses was unusually large. This, however, was made necessary by the unexpectedly—but nevertheless welcome—large total registration for both the meeting and for the courses. On the fortunate side of the picture was the fact that the Palmer House was able to provide two such adequate rooms as the Red Lacquer Room and the Grand Ball Room, thus averting disappointment to the many applicants.

The success of this series of Refresher Courses is a source of real enjoyment to the members of the Committee and to both of the participating societies. May there be many, many more programs of this type and may they be even more successful.

B. R. KIRKLIN, M.D.
IRA H. LOCKWOOD, M.D.
LESTER A. SMITH, M.D.
WARREN W. FUREY, M.D., *Chairman*

## TECHNICIANS WANTED

The Editor has received from the Public Relations Office of the U. S. Army Recruiting Service a communication urging the enlistment of x-ray technicians in the Woman's Army Corps (WACS). The aim is to recruit 22,000 medical technicians of various types, including x-ray technicians, by Jan. 1, 1945.

"Qualifications include the following: American citizenship; 20–49 years of age, inclusive; satisfactory rating on the Army mental test; good health; no children under 14 years of age. Educational qualifications vary with the type of job; however, in every case the applicant must be at least a high school graduate.

"Women who are eligible for these positions will be sent to either Fort Oglethorpe, Georgia, or Fort Des Moines, Iowa, for six weeks' basic training. If they have had the technical training and necessary experience at the time of their enlistment, they will be assigned, upon completion of basic training, to medical jobs in Army hospitals either in this country or overseas. If they have not been technically trained, they may be sent to Army schools where they will be instructed for medical positions at Army expense.

"The Army conducts medical schools for women who are high school graduates even though they have had no medical training or experience. The following Army schools are now open: Dental Technician School (three months' course); X-ray Technician School (12 weeks' course; qualifications include high school courses in physics); Medical Laboratory Technician School (13 weeks' course); Medical Technician School (8 weeks' course); Surgical Technician School (8 weeks' course).

"Women who join the Army receive all the benefits accruing to men in the Service, including post-war security through the GI Bill of Rights.

"Thousands of injured men are coming back from the fronts, and the longer the war lasts, the more WACS will be needed to help doctors and nurses care for these soldiers who have given so much for an American victory."

## ERRATUM

A regrettable error occurs in the paper by Capt. Peter Zanca and Lieut.-Col. Frederick K. Herpel—"A Statistical Analysis of 100,000 Examinations of the Chest by the Photoroentgen Method"—in the August issue of RADIOLOGY. The rejection rates for white and colored soldiers were unfortunately figured on an incorrect basis. The columns headed Rejection Rates per Thousand in Tables II, III, V, and VI (pages 123–126) should be corrected to read as follows:

TABLE II

| Col. | White | Total |
|---|---|---|
| ... | 0.04 | 0.02 |
| ... | ... | ... |
| ... | 0.02 | 0.01 |
| 0.01 | 0.04 | 0.03 |
| ... | ... | ... |
| ... | ... | ... |
| ... | ... | ... |
| ... | ... | ... |
| ... | ... | ... |
| ... | 0.13 | 0.06 |
| 0.01 | ... | 0.01 |
| 0.03 | 0.02 | 0.03 |
| ... | ... | ... |
| 0.59 | 0.17 | 0.35 |
| 0.71 | 0.22 | 0.49 |
| 0.03 | 0.02 | 0.03 |
| 0.11 | ... | 0.06 |
| 0.05 | 0.08 | 0.07 |
| ... | 0.02 | 0.01 |
| 0.01 | ... | 0.01 |
| 1.50 | 0.79 | 1.18 |

TABLE III

| Col. | White | Total |
|---|---|---|
| 0.01 | ... | 0.01 |
| ... | 0.04 | 0.02 |
| ... | ... | ... |
| 0.16 | 0.26 | 0.21 |
| 1.61 | 1.82 | 1.71 |
| 0.27 | 0.21 | 0.25 |
| 0.20 | 0.10 | 0.16 |
| 0.25 | 0.26 | 0.26 |
| 0.03 | ... | 0.02 |
| 0.01 | 0.02 | 0.02 |
| 0.05 | 0.06 | 0.06 |
| 0.01 | 0.02 | 0.02 |
| 2.66 | 2.83 | 2.74 |
| 0.07 | 0.13 | 0.10 |
| 0.62 | 0.79 | 0.70 |
| 1.12 | 1.44 | 1.27 |
| 1.81 | 2.37 | 2.07 |
| 0.05 | 0.15 | 0.10 |
| 4.53 | 5.35 | 4.91 |

TABLE V

| Col. | White | Total |
|---|---|---|
| ... | ... | ... |
| 0.03 | 0.02 | 0.03 |
| 0.03 | 0.06 | 0.05 |
| 0.07 | ... | 0.04 |
| 0.49 | 0.70 | 0.59 |
| 0.12 | 0.06 | 0.10 |
| 0.78 | 0.30 | 0.57 |
| 0.16 | 0.08 | 0.13 |
| 0.07 | 0.04 | 0.06 |
| 0.01 | 0.02 | 0.02 |
| 0.01 | 0.02 | 0.02 |
| 0.55 | 0.41 | 0.49 |
| 0.34 | 0.15 | 0.26 |
| 0.09 | 0.04 | 0.07 |
| 0.07 | 0.02 | 0.05 |
| 0.14 | 0.15 | 0.26 |
| 0.01 | ... | 0.01 |
| 0.77 | 0.70 | 0.74 |
| 0.11 | 0.04 | 0.08 |
| 0.03 | ... | 0.02 |
| ... | 0.02 | 0.01 |
| 0.07 | 0.04 | 0.06 |
| 4.05 | 2.94 | 3.55 |

TABLE VI

| Col. | White | Total |
|---|---|---|
| 0.03 | 0.02 | 0.03 |
| ... | ... | ... |
| 0.11 | 0.15 | 0.13 |
| 0.66 | 0.24 | 0.47 |
| 0.84 | 0.30 | 0.60 |
| 2.62 | 0.68 | 1.74 |
| 1.13 | 0.17 | 0.70 |
| 0.22 | 0.04 | 0.14 |
| 0.01 | ... | 0.01 |
| 0.03 | 0.02 | 0.03 |
| 0.01 | ... | 0.01 |
| 0.01 | ... | 0.01 |
| 5.72 | 1.64 | 3.87 |

In Table IV, the last line, showing the rejection rate per thousand, should be corrected to read, in Column 1 (Active), Col. 2.66, Wh. 2.83, Total 2.74; in Column 2 (Arrested), Col. 1.81, Wh. 2.37, Total 2.07; in Column 3 (Questionable Activity), Col.

0.05, Wh. 0.15, Total 0.10; in Column 4 (Total), Col. 4.53, Wh. 5.35, Total 4.91.

The authors greatly regret the necessity of these corrections.

## Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender Reviews will be published in the interest of our readers and as space permits.

METASTASES, MEDICAL AND SURGICAL. By MALFORD W. THEWLIS, M.D., Attending Specialist in General Medicine, United States Public Health Hospitals, New York City; Attending Physician, South County Hospital, Wakefield, Rhode Island; Special Consultant, Rhode Island Department Public Health; Author Care of the Aged (Geriatrics), Preclinical Medicine. Foreword by HUBERT A. ROYSTER, A.B., M.D., F.A.C.S., Honorary Chief Surgical Service, Rex Hospital; Chief-of-Staff, St. Agnes Hospital; Consulting Surgeon, Dix Hill State Hospital; Fellow American Board of Surgery, Raleigh. A volume of 230 pages, with 13 illustrations. Published by the Charlotte Medical Press, Charlotte, N. C., 1944. Price $5.00.

THE MEDICAL ANNUAL 1944. A YEAR BOOK OF TREATMENT AND PRACTITIONER'S INDEX. Editors: Sir HENRY TIDY, K.B.E., M.A., M.D. (Oxon.), F.R.C.P., and A. RENDLE SHORT, M.D., B.S., B.Sc., F.R.C.S. Published by John Wright & Sons Ltd., Bristol, and Simpkin Marshall (1941) Ltd., London.

## Book Reviews

RADIATION AND CLIMATIC THERAPY OF CHRONIC PULMONARY DISEASES, WITH SPECIAL REFERENCE TO NATURAL AND ARTIFICIAL HELIOTHERAPY, X-RAY THERAPY, AND CLIMATIC THERAPY OF CHRONIC PULMONARY DISEASES AND ALL FORMS OF TUBERCULOSIS. Edited by EDGAR MAYER, M.D., F.A.C.P., F.A.C.C.P., Assistant Professor of Clinical Medicine, Cornell University Medical College, New York City; Attending Physician New York and Memorial Hospitals; Special Pulmonary Consultant, New York State Department of Labor; Formerly Member Faculty Trudeau School for Tuberculosis; Director (ex urbe) Northwoods and Will Rogers Tuberculosis Sanatoria, Saranac Lake, New York; Consultant on Tuberculosis to the Government of Cuba; Board Member of the Finlay Institute of the Americas. With the collaboration of the following contributors: Louis Beardslee Baldwin, Irvin I. Balensweig, Alfred Lee Briskman, William Chang, Anthony C. Cipollaro, William W. Coblentz, Lloyd F. Craver, Martin Dworkin, Earl C. Elkins, John N. Hayes, Ira I. Kaplan, H. Haig Kasabach, Eugene Kisch, Frank H. Krusen, Henry Laurens, Maurice Lenz, Horace LoGrasso, Harriet C. McIntosh, Clarence A. Mills, Leroy S. Peters, Homer L. Sampson, Stanley L. Wang. A volume of 393 pages, with 46 illustrations. Published by The Williams and Wilkins Company, Baltimore, 1944. Price $5.00.

This timely and excellent monograph covers the whole field of climatic and radiation therapy of chest diseases, with special stress on pulmonary and extrapulmonary tuberculosis. Chapters are included on the physics and physiologic action of light, and the various sources of artificial light therapy are discussed in detail with technic and dosage as applied to tuberculous involvement of the different organs of the body. In the chapters on solar radiation and climatotherapy, the climatic conditions of the better known tuberculosis resorts throughout the country are presented. These data should be helpful in selecting a resort for the patient.

The x-ray therapy of chronic non-tuberculous mediastinal and pulmonary disease is also discussed. While this form of therapy in most chest diseases is largely on an empirical basis, unquestionably beneficial results have at times been obtained. Pressure symptoms resulting from enlarged mediastinal lymph nodes generally respond to radiation therapy. For each disease, technic and dosage are given.

In view of the definite increase in the incidence of cancer of the lung, the essay on x-ray therapy for intrathoracic tumors is particularly timely. Emphasis is placed on the importance of histologic diagnosis before instituting either operative or x-ray therapy. If this is established, the choice between surgery and irradiation is simplified.

As frequently happens, the medical pendulum has swung to extremes in the use of climatotherapy. It is not so long since climate was regarded as the most important factor in the treatment of pulmonary tuberculosis. The tendency today is to attribute little if any value to it. This monograph stresses the therapeutic value of climate and light in properly selected cases. In pulmonary tuberculosis, for instance, the importance of a qualitative diagnosis is highly emphasized. Exudative or caseous lesions are likely to break down under light therapy. The fibrotic or productive lesions usually respond favorably. The selection of light therapy is always an individualized procedure, requiring time and effort on the part of the physician to determine dosage and the kind and source of light. Precise information is given on how to determine skin and constitutional reactions and how these factors influence dosage and choice of therapy.

The book will be found valuable for reference.

Sooner or later, a physician is consulted as to the advisability of change of climate or use of heliotherapy. Exact information on these points is available in this monograph. Finally, Mayer's résumé on climatic, x-ray, and light therapy of chronic pulmonary diseases and all forms of tuberculosis will be found decidedly helpful in assessing these factors in relation to the person and his disease.

THE MODERN MANAGEMENT OF COLITIS. By J. ARNOLD BARGEN, M.D., M.S., F.A.C.P., Chief of the Section on Intestinal Diseases, Division of Medicine, Mayo Clinic; Associate Professor of Medicine, Mayo Foundation, Rochester, Minnesota; Secretary, American Gastroenterological Association; Vice-Chairman, Section on Gastroenterology and Proctology, American Medical Association. A volume of 322 pages, with 148 figures. Published by Charles C Thomas, Springfield, Ill. Price $7.00.

This book reflects the enormous experience of the author in the diagnosis and treatment of ulcerative colitis. At the outset he distinguishes between so-called "mucous colitis," which "actually should never masquerade under the name of 'colitis'," and true ulcerative colitis. He includes an excellent chapter on the former condition under the heading "The Irritable Colon," with appropriate emphasis on the treatment of the emotionally unstable patient and a timely consideration of the use of laxatives, enemas, and colonic irrigations.

Ulcerative colitis is helpfully classified under nine headings: (1) thrombo-ulcerative colitis of streptococcal origin; (2) regional (segmental) ulcerative colitis; (3) a type not distinguishable pathologically from the second type but tending to involve the rectum, with or without involvement of segments higher in the colon; (4) tuberculous ulcerative colitis; (5) amebic ulcerative colitis; (6) colitis associated with dietary deficiencies; (7) a type due to the virus of venereal lymphogranuloma; (8) a type associated with allergy; (9) the type occurring as a late phase of bacillary dysentery. To each of these a chapter is devoted, with a discussion of the causative factors, diagnosis, and treatment, including surgical indications.

A final chapter enumerates the conditions to be differentiated from colitis, including polyposis, cancer, regional enteritis, diverticulosis and diverticulitis, food poisoning, parasitic diseases, appendicitis, deficiency diseases, volvulus and intussusception, benign stricture, and gallbladder disease

Appropriate cases are presented to demonstrate the points made in the author's discussion and numerous illustrations show the pathologic and roentgen findings.

X-RAY EXAMINATION OF THE STOMACH. A DESCRIPTION OF THE ROENTGENOLOGIC ANATOMY, PHYSIOLOGY, AND PATHOLOGY OF THE ESOPHAGUS, STOMACH, AND DUODENUM. By FREDERIC E. TEMPLETON, M.D., Head of the Department of Roentgenology, The Cleveland Clinic. A volume of 516 pages, with 287 reproductions of x-ray plates. Published by the University of Chicago Press, Chicago, Ill. Price $10.00.

Doctor Templeton's new volume dealing with the roentgen examination of the upper digestive tract will be a valuable addition to the library of every roentgenologist. As in most modern radiological textbooks, considerable emphasis is placed on anatomical, physiological, and clinical features. Most of the diseases that involve the upper digestive tract are described in detail, and in each instance the attempt is made to correlate the anatomic and pathologic changes with the diagnostic evidence furnished by the screen and film. The discussion of the various lesions involving the esophagus, stomach, and duodenum is preceded by chapters on the normal findings in these organs and the basic principles of interpretation.

The book is of special value because of its presentation of the more recent developments in gastric roentgenology, such as mucosal studies and the filming fluoroscope. A full description is given of the various steps of the fluoroscopic examination, including relief technic and the use of compression in demonstrating the mucosal pattern. A chapter is devoted to the filming fluoroscope.

The book is amply illustrated and provided with an adequate index.

# RADIOLOGICAL SOCIETIES OF NORTH AMERICA

*Editor's Note.*—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit 2, Mich.

## UNITED STATES

*Radiological Society of North America.—Secretary,* D. S. Childs, M.D., 607 Medical Arts Building, Syracuse 2, N. Y.

*American Roentgen Ray Society.—Secretary,* Harold Dabney Kerr, M.D., Iowa City, Iowa.

*American College of Radiology.—Secretary,* Mac F. Cahal, 540 N. Michigan Ave., Chicago 11, Ill.

*Section on Radiology, American Medical Association.—Secretary,* U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

### ARKANSAS

*Arkansas Radiological Society.—Secretary,* J. S. Wilson, M.D., Monticello. Meets every three months and annually at meeting of State Medical Society.

### CALIFORNIA

*California Medical Association, Section on Radiology.—Secretary,* Earl R. Miller, M.D., University of California Hospital, San Francisco, Calif.

*Los Angeles County Medical Association, Radiological Section.—Secretary,* Roy W. Johnson, M.D., 1407 South Hope St., Los Angeles. Meets second Wednesday of each month at County Society Building.

*Pacific Roentgen Society.—Secretary,* L. Henry Garland, M.D., 450 Sutter St., San Francisco. Meets annually during meeting of California Medical Association.

*San Diego Roentgen Society.—Secretary,* Henry L. Jaffe, M.D., Naval Hospital, Balboa Park, Calif. Meets first Wednesday of each month.

*San Francisco Radiological Society.—Secretary,* Martha Mottram, M.D., Suite 1789, 450 Sutter St., San Francisco. Meets monthly on third Thursday at 7:45 P.M., in Toland Hall, University of California Hospital, from January to June; at Lane Hall, Stanford University Hospital, July to December.

### COLORADO

*Denver Radiological Club.—Secretary,* A. Page Jackson, Jr., M.D., 304 Republic Bldg., Denver 2. Meetings third Friday of each month at the Denver Athletic Club.

### CONNECTICUT

*Connecticut State Medical Society, Section on Radiology.—Secretary,* Max Climan, M.D., 242 Trumbull St., Hartford 3. Meetings bimonthly, second Thursday.

### FLORIDA

*Florida Radiological Society.—Secretary-Treasurer,* Charles M. Gray, 306 Citizens Bldg., Tampa 2.

### GEORGIA

*Georgia Radiological Society.—Secretary-Treasurer,* James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meetings twice annually, in November and at the annual meeting of State Medical Association.

### ILLINOIS

*Chicago Roentgen Society.—Secretary,* Warren W. Furey, M.D., 7144 Jeffery Ave., Chicago 49. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

*Illinois Radiological Society.—Secretary-Treasurer,* William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

*Illinois State Medical Society, Section on Radiology.—Secretary,* Fay H. Squire, M.D., 1753 W. Congress St., Chicago 12.

### INDIANA

*The Indiana Roentgen Society.—Secretary-Treasurer,* Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis 7. Annual meeting in May.

### IOWA

*The Iowa X-ray Club.*—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

### KENTUCKY

*Kentucky Radiological Society.—Secretary-Treasurer,* Sydney E. Johnson, M.D., Louisville City Hospital, Louisville. Meeting annually in Louisville, third Saturday afternoon in April.

### LOUISIANA

*Louisiana Radiological Society.—Secretary-Treasurer,* Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

*Shreveport Radiological Club.—Secretary-Treasurer,* R. W. Cooper, 940 Margaret Place. Meetings monthly on the second Wednesday, at the offices of the various members.

### MARYLAND

*Baltimore City Medical Society, Radiological Section.—Secretary,* Walter L. Kilby, M.D., 101 W. Read St., Baltimore 1. Meets third Tuesday of each month.

### MICHIGAN

*Detroit X-ray and Radium Society.—Secretary-Treasurer,* E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave., Detroit.

*Michigan Association of Roentgenologists.—Secretary-Treasurer,* E. M. Shebesta, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

### MINNESOTA

*Minnesota Radiological Society.—Secretary,* A. J. Stenstrom, M.D., Minneapolis General Hospital, Minneapolis 26. Meetings quarterly.

### MISSOURI

*Radiological Society of Greater Kansas City.—Secretary,* Arthur B. Smith, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

*The St. Louis Society of Radiologists.—Secretary,* E. W. Spinzig, M.D., 2646 Potomac St. Meets on fourth Wednesday of each month except June, July, August, and September, at a place designated by the president.

### NEBRASKA

*Nebraska Radiological Society.—Secretary,* F. L. Simonds, M.D., 1216 Medical Arts Bldg., Omaha 2. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

### NEW ENGLAND

*New England Roentgen Ray Society* (Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island).—*Secretary-Treasurer,* George Levene, M.D., Massachusetts Memorial Hospitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

### NEW JERSEY

*Radiological Society of New Jersey.—Secretary,* H. R. Brindle, M.D., 501 Grand Ave., Asbury Park. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called by president.

### NEW YORK

*Associated Radiologists of New York, Inc.,—Secretary,* William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

*Brooklyn Roentgen Ray Society.—Secretary-Treasurer,* Leo Harrington, M.D., 880 Ocean Ave., Brooklyn 26. Meets fourth Tuesday of every month, October to April.

*Buffalo Radiological Society.—Secretary-Treasurer,* Joseph S. Gianfranceschi, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month. October to May, inclusive.

*Central New York Roentgen Ray Society.—Secretary-Treasurer,* Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings are held in January, May, and October, as called by Executive Committee.

*Long Island Radiological Society.—Secretary,* Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

*New York Roentgen Society.—Secretary,* Ramsay Spillman, M.D., 115 E. 61st St., New York 21, N. Y.

*Rochester Roentgen-ray Society.—Secretary,* Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meetings at convenience of committee.

### NORTH CAROLINA

*Radiological Society of North Carolina.—Secretary-Treasurer,* Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meeting with State meeting in May, and meeting in October.

### NORTH DAKOTA

*North Dakota Radiological Society.—Secretary,* L. A. Nash, M.D., St. John's Hospital, Fargo. Meetings by announcement.

### OHIO

*Ohio Radiological Society.—Secretary,* Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting will be held at the time and place of the annual meeting of the Ohio State Medical Association.

*Cleveland Radiological Society.—Secretary-Treasurer,* Don D. Brannan, M.D., 11311 Shaker Blvd., Cleveland 4. Meetings at 6:30 P.M. on fourth Monday of each month from October to April, inclusive.

*Radiological Society of the Academy of Medicine* (Cincinnati Roentgenologists).—*Secretary-Treasurer,* Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meetings held third Tuesday of each month.

### PENNSYLVANIA

*Pennsylvania Radiological Society.—Secretary-Treasurer,* L. E. Wurster, M.D., 416 Pine St., Williamsport 8. The Society meets annually.

*The Philadelphia Roentgen Ray Society.—Secretary,* Robert P. Barden, M.D., 3400 Spruce St., Philadelphia 4. Meetings held first Thursday of each month at 8:15 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St., Philadelphia.

*The Pittsburgh Roentgen Society.—Secretary-Treasurer,* Lester M. J. Freedman, M.D., 4800 Friendship Ave., Pittsburgh 24, Pa. Meetings are held on the second Wednesday of each month at 4:30 P.M., from October to June, at the Pittsburgh Academy of Medicine, 322 N. Craig St.

### ROCKY MOUNTAIN STATES

*Rocky Mountain Radiological Society* (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—*Secretary,* A. M. Popma, M.D., 220 North First St., Boise, Idaho.

### SOUTH CAROLINA

*South Carolina X-ray Society.—Secretary-Treasurer* Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16. Meeting in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

### TENNESSEE

*Memphis Roentgen Club.*—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

*Tennessee Radiological Society.—Secretary-Treasurer,* J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meeting annually with State Medical Society in April.

### TEXAS

*Texas Radiological Society.—Secretary-Treasurer,* Herman Klapproth M.D., Sherman.

### VIRGINIA

*Virginia Radiological Society.—Secretary,* E. Latané Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

### WASHINGTON

*Washington State Radiological Society.—Secretary-Treasurer,* Thomas Carlile, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday of each month, October through May, at College Club, Seattle.

### WISCONSIN

*Milwaukee Roentgen Ray Society.—Secretary-Treasurer,* C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

*Radiological Section of the Wisconsin State Medical Society.—Secretary,* Russell F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

*University of Wisconsin Radiological Conference.—Secretary,* E. A. Pohle, M.D., 1300 University Ave., Madison 6, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute

## CANADA

*La Société Canadienne-Française d'Electrologie et de Radiologie Médicales.—General Secretary,* Origène Dufresne, M.D., Institut du Radium, Montreal. Meetings are held the third Saturday of each month, generally at the Radium Institute, 4120 East Ontario Street, Montreal; sometimes, at homes of members.

## CUBA

*Sociedad de Radiología y Fisioterapia de Cuba.*—Offices in Hospital Mercedes, Havana. Meetings are held monthly.

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# ROENTGEN DIAGNOSIS

## THE HEAD AND NECK

**Pneumoencephalography in the Study of the Sequelae of Head Injuries.** Frank H. Mayfield and Joseph C. Bell. South. M. J. **37:** 142–149, March 1944.

This paper deals with the fundamental principles of pneumo-encephalography. It sets forth a simple technical procedure and describes, with several illustrations, a few of the diagnostic roentgenologic criteria of post-traumatic encephalopathy.

The patient is prepared with pentobarbital sodium and morphine sedation and brought for examination with an empty stomach. A special cassette-holding device, attached to the tube housing, facilitates the procedure by maintaining a fixed distance measurement and eliminates the hazard of exposing the technician. With a well co-ordinated team, the procedure can easily be completed in less than one-half hour. The authors believe that this examination should *not* be done in the presence of increased intracranial pressure.

Failure of the ventricles to fill is not a reliable indication of disease, since a second injection will often result in a normal outline. Enlargement of cerebral fissures is of little diagnostic value unless associated with ventricular deformity or displacement. Symmetrical enlargement of the ventricles is, of course, strongly suggestive of an obstructive lesion which may require surgical treatment. A similar picture is produced by diffuse cerebral atrophy. Unilateral hydrocephalus without displacement generally means local cerebral atrophy on the affected side. If the ventricular system is shifted toward the dilated ventricle, the condition is due to a meningocerebral scar or great loss of cerebral substance, as in compound injuries with infection.

Porencephaly may be found in traumatic epilepsy or post-concussion states. This term is used to cover all cystic defects communicating with the ventricular system, congenital or acquired. Enlargement of the third ventricle alone is generally to be disregarded. Gas over the cerebellum is indicative of cerebellar atrophy but this condition is extremely rare except as a part of a generalized atrophy. The cisterna magna varies considerably in size in normal subjects and such variations must not be interpreted too closely.

As regards therapeutic benefits from encephalography, the authors are of the opinion that occasionally temporary symptomatic relief is obtained but that the procedure is not justified for this purpose.

MAX MASS, M.D.

**Osteochondroma of the Base of the Skull.** Lester S. King and James Butcher. Arch. Path. **37:** 282–285, April 1944.

The case of osteochondroma of the base of the skull here presented is unusual in that the neurologic symptoms were not displayed until terminally.

A 26-year-old man with a history of intermittent peptic ulcer for five years was admitted to the hospital for treatment of gastric distress. Roentgen studies of the gastro-intestinal tract showed a non-obstructive duodenal ulcer. The patient complained, also, of a vague headache. Routine roentgen examination of the sinuses incidentally revealed a large irregular mass, extending upward from the right lateral margin of the sella turcica. In spite of the location of the tumor in the region of the chiasm, the fundi, visual fields, and the eye movements were entirely normal. About four weeks after the onset of the headache, the patient suddenly collapsed and died with signs of cerebral (subarachnoid) hemorrhage. At autopsy, the mass apparent on the roentgenogram proved to be an osteochondroma of the sphenoid bone.

## THE CHEST

**Pulmonary Conditions in Rejectees: Analysis of 2,270 Selectees Rejected for Pulmonary Conditions in the Induction Centres of Massachusetts.** David Zacks and Robert W. Hyde. Am. Rev. Tuberc. **49:** 332–342, April 1944.

An analysis is presented of 2,270 men rejected or deferred for military service because of pulmonary conditions discovered on miniature x-ray films. Of these, 1,385, or 66 per cent, had a clinical follow-up study after the original x-ray examination. The majority of the lesions found were tuberculous, either of the reinfection or primary type. The non-tuberculous lesions were largely bronchiectasis, silicosis, sarcoidosis, non-tuberculous fibrosis, and pulmonary abscess. Three hundred and ninety-five men were listed as "pulmonary suspects," and 160 of these were successfully followed and studied. It was found that 86, or 54 per cent of this number, had pulmonary tuberculosis, while the others showed normal chests, healed primary tuberculosis, or non-tuberculous pulmonary disease.

In the group in whom pulmonary tuberculosis was diagnosed on the original study, follow-up examinations revealed an error of commission of 5 per cent. Also, the differentiation between a primary and a reinfection type of lesion could not always be made with certainty when the lesion was early and active. At this stage it was difficult to determine whether or not the lesion was tuberculous, since an acute or subacute atypical pneumonia may present a similar appearance. It is recommended that these patients should be put to bed and then observed monthly with x-ray studies. The acute non-tuberculous lesion will usually clear within three months. Lesions persisting longer than three months, or showing spread, should be regarded as tuberculous.

Sixty-six per cent of the cases of pulmonary tuberculosis discovered were previously unknown, while 34 per cent had been reported to the Board of Health. According to the stage of disease, there were 67 per cent minimal lesions, 23 per cent moderately advanced, and 10 per cent advanced. The order of this distribution by stages is the reverse of that usually found in sanatorium admissions.

L. W. PAUL, M.D.

**Primary Atypical Pneumonia, Etiology Unknown.** John H. Dingle *et al.* Am. J. Hyg. **39:** 67–128, January; 197–268, March; 269–336, May, 1944.

This is a full report of a study of primary atypical pneumonia made at Camp Claiborne, La., previously reported more briefly by the same writers in War Medicine (**3:** 223–248, 1943) and abstracted in Radiology (**42:** 407, April 1944). Appended to this presentation are tables of the clinical, roentgenological,

and laboratory findings, accounts of serologic studies, bronchoscopic examinations, and complement-fixation tests for Q fever, and an autopsy report of one case.

**Diagnosis and Treatment of Bronchiogenic Cysts of the Mediastinum and Lung.** Robert K. Brown and Laurence L. Robbins. J. Thoracic Surg. **13:** 84–105, April 1944.

This paper is a review of 21 bronchiogenic cysts of the lung and mediastinum. Twelve were in the mediastinum and 9 in the lung. The symptoms depend on the location and size of the cysts and the presence or absence of infection. Pain is the most common complaint, followed by cough, expectoration, hemoptysis, and dysphagia. The preoperative diagnosis depends largely on roentgen examination. The mediastinal cysts may be anywhere in the mediastinum and are smooth and round, often attached to the trachea or main bronchi. Unless the cyst communicates with the bronchus and shows a fluid level, a malignant tumor cannot be definitely excluded, making surgery almost a necessity. Lung cysts are also smooth and round and are most often in the lower part of the chest. Surgical removal is the treatment of choice.

Case histories are presented for all 21 patients, and representative roentgenograms are reproduced.

HAROLD O. PETERSON, M.D.

**Intrathoracic Neurogenic Tumors.** Edward M. Kent, Brian Blades, Anibal Roberto Valle, and Evarts A. Graham. J. Thoracic Surg. **13:** 116–161, April 1944.

The authors studied 18 proved and 3 presumptive cases of intrathoracic neurogenic tumors. Abstracts of all these cases are presented together with roentgenograms, photographs of the gross specimens, and photomicrographs for many of them. In addition, 105 cases from the literature are listed. Forty-one per cent of the authors' series and 37 per cent of the reported cases were considered to be malignant, in spite of the common belief that these tumors are benign. The most common tumor in the posterior mediastinum is one of neurogenic origin. Among 101 reported cases, there were only 2 examples in the anterior mediastinum.

Symptoms may be absent or there may be pain, dyspnea, cough, stridor, and hoarseness. The tumors are usually single, rounded and smooth in outline. There may be rib erosion. A lobulated appearance suggests rapid growth. A pleural effusion does not definitely indicate malignancy. Radiation therapy is of no value, the only effective treatment being surgical removal. HAROLD O. PETERSON, M.D.

**Carcinoma of the Lung in a Ten Year Old Negro Boy.** Béla Halpert and Peter E. Russo. Arch. Path. **37:** 290–293, April 1944.

According to Ochsner and DeBakey (Arch. Surg. **42:** 209, 1941) carcinoma of the lung metastasizes most frequently to the regional lymph nodes, next most frequently to the liver, third to the skeleton, and fourth to the adrenal glands. In the case reported here, in a ten-year-old Negro boy, skeletal involvement was the dominant feature and there was no metastasis to either the liver or the adrenals. Skeletal lesions produced by pulmonary cancer are usually osteolytic, destroying bony structure and pattern. In the present case the growth seemed to be osteoplastic, filling the marrow spaces, which were separated by broad and intact lamellas, and broadening the periosteal zones. Death occurred about eight months after the onset of symptoms.

**Roentgenographic Demonstration by Diodrast of the Pleural Walls in Open Empyema.** Joseph Gordon. J. Thoracic Surg. **13:** 162–165, April 1944.

Because of the difficulty of completely outlining an empyema pocket by means of iodized oils, the authors have used either diodrast in a 35 per cent solution or skiodan in acacia. This material is sprayed into the empyema cavity with the aid of a nebulizer connected to a small air pump. About 10 c.c. of solution is used. The procedure so far has been employed only in open pleural cavities. The spray coats the walls, which then show up clearly on the roentgenogram.

HAROLD O. PETERSON, M.D.

**Encapsulated Pleural Effusion Due to Heart Failure: Report of Two Cases.** Abraham H. Russakoff and Tobias Weinberg. New England J. Med. **230:** 379–381, March 30, 1944.

Less than 50 cases of encapsulated pleural effusion due to heart failure have been reported in the literature. The first case was found and proved at autopsy in 1912. This condition has been considered rather rare, but in a series of 368 cases of heart failure, 35 per cent were found to have x-ray evidence of simple hydrothorax, and among these were 11, or 8 per cent, with interlobar effusions.

Roentgenologically effusions in the interlobar spaces may appear round, ovoid, band- or wedge-shaped. They are best demonstrated by both postero-anterior and lateral views of the chest.

According to Stein and Schwedel (Am. Heart J. **10:** 230, 1934), in the hydrothorax of cardiac decompensation some of the fluid may seep into the interlobar fissure and remain after obliteration of the pleural space has occurred following organization of fibrin.

Two case reports are presented with roentgenograms demonstrating the encapsulated pleural effusion.

JOHN B. MCANENY, M.D.

## THE DIGESTIVE SYSTEM

**Roentgenological Appearance of the Gastrointestinal Tract in Scleroderma.** Clayton H. Hale and Richard Schatzki. Am. J. Roentgenol. **51:** 407–420, April 1944.

The roentgen appearance of the gastro-intestinal tract in 22 patients with scleroderma is described. In 7 of the group, examination of the esophagus was made because of dysphagia. The remaining 15 had no definite symptoms referable to the esophagus and were examined routinely for the purpose of this study. Five of the 7 patients complaining of dysphagia, and 8 of those who were without subjective symptoms showed roentgenologic abnormalities.

While some variation occurred, the appearance in the esophagus followed a certain pattern. There was delay in the passage of the barium from the pharynx to the stomach, and in some cases complete emptying of the esophagus was delayed for as much as half an hour. As a rule, the barium passed into the stomach as a slow but fairly constant trickle. In several patients the lower end of the esophagus appeared slightly

narrower than usual and there was dilatation above the level of narrowing. No gross dilatation, however, such as is common in cardiospasm was seen in any of the patients. In one case the esophagus appeared narrower than normal throughout its entire course. A decrease in the peristaltic activity was present. All of the abnormalities noted were more marked in the horizontal position, giving the impression that the esophagus had lost its normal peristaltic force and that its emptying was more or less dependent upon gravity.

Examination of the stomach revealed considerable delay in emptying in some of the cases, but the significance of the changes was doubtful.

In 4 of 18 patients in whom the small intestine was studied, extensive roentgenologic changes were encountered. These consisted in unusual widening of the part of the intestine involved, with delayed emptying time of these loops. This dilatation involved the upper small intestine, including the duodenum, in all 4 patients and in one instance extended downward into the ileum. The similarity to severe cases of deficiency disease was striking, but the abnormalities seemed to be more localized than is usually seen in deficiency conditions.

Two of the patients showed an unusual appearance in the large intestine. Areas of sacculation were seen alternating with areas of rigidity, as in ulcerative colitis. The connection of the changes in the colon with the scleroderma is questionable, but a possible relationship is suggested. L. W. PAUL, M.D.

**Symposium on Abdominal Surgery. Indications for, and Experiences with, Total Gastrectomy, Based upon 73 Cases of Total Gastrectomy.** Frank H. Lahey and Samuel F. Marshall. Ann. Surg. **119:** 300–317, March 1944.

This article is based on a study of 73 cases in which total gastrectomy was performed at the Lahey Clinic; it includes 8 cases previously reported (Surg., Gynec. & Obst. **67:** 213, 1938. Abst. in Radiology **31:** 648, 1938). The total operative mortality was 33 per cent, but for 28 patients operated on in the last two years this had been reduced to 18 per cent.

Two types of gastric carcinoma are recognized: (1) localized, which "so often proves inoperable, is frequently on the lesser or greater curvature and rapidly metastasizes to the adjacent lymph nodes"; (2) linitis plastica, with intramural infiltration. It is this second type, with little lymph node involvement, that is apparently most amenable to total gastrectomy. Lymphosarcoma also lends itself to this radical measure, as do leiomyoma with sarcomatous change and carcinoma of the cardia.

The authors favor gastrectomy through the abdomen, with anastomosis of the jejunal stump to the esophagus, rather than transpleural resection. The abdominal approach is more satisfactory for exploration and permits removal of the omentum and spleen as well as mobilization and inversion of the duodenum.

After discussing the details of preoperative preparation and anesthesia, the authors turn to a consideration of operability, which can be determined only after the abdomen has been opened. Pelvic metastases and metastatic nodes and the direct extension of peritoneal implants in the jejunal fossa are contraindications to gastrectomy. A few firm nodes in the omentum need not in themselves rule out a radical operation, since the omentum can be removed with the stomach, but direct extension to the root of the mesentery of the transverse colon makes the condition inoperable, as do peritoneal implants about the stomach and involvement of the chain of nodes running up through the diaphragm beside the esophagus. Another important decision to be made before attempting total gastrectomy is whether an adequate amount of esophagus remains uninvolved by the carcinoma for a satisfactory anastomosis with the jejunum. Even though a small portion is involved, as soon as the parietal and diaphragmatic peritoneum and the vagus nerves are cut, a considerable length of esophagus can still be pulled out of the pleural cavity for a safe and comfortable anastomosis.

The operative technic is described, and drawings show the successive steps in the procedure. The chief cause of postoperative death is peritonitis, accounting for 14 of the 24 fatalities in this series; the remainder were due to shock, coronary occlusion, pulmonary embolism, myocardial failure, bronchopneumonia, and mediastinitis. As suggested above, there has been a considerable diminution in the number of operative deaths as greater technical and selective experience has been acquired. There were 23 deaths from recurrence, 21 of these between six months and two years following operation. Twenty-six of the 73 patients operated upon were alive at the time of the report without "definite evidence of recurrence," but in only 2 instances was the postoperative period as long as five years. One patient was alive and well six years after total gastrectomy for leiomyosarcoma.

The authors conclude that few if any cures will result from total gastrectomy except possibly of leiomyosarcoma, though prolongation of life may be expected in a large percentage of cases.

V. A. LOOKANOFF, M.D.

**Symposium on Abdominal Surgery. Acute Perforation in Gastroduodenal Ulceration: with Special Reference to End-Results.** W. L. Estes, Jr., and B. A. Bennett, Jr. Ann. Surg. **119:** 321–338, March 1944.

This article is an analysis of 80 cases of acute perforated gastroduodenal ulceration. The series includes 63 duodenal ulcers, 16 gastric ulcers, and 1 of the jejunum. The greatest number of cases, 28.7 per cent, occurred in the fifth decade, with 22.5 per cent in the sixth and 18.7 per cent in the third. The age incidence for perforation of gastric ulcer and duodenal ulcer differed, the highest incidence of the former (31.2 per cent) being in the fifth and sixth decades and of the latter (30 per cent) in the third decade. There were only 2 females in this series.

Forty cases were studied from the point of view of etiology. In 27 of these there was some relation to food intake. Physical strain was a factor in 6 cases.

All of the patients gave a history of intense, unrelenting abdominal pain of sudden onset. This agonizing pain, a scaphoid abdomen, often with a transverse depression across the epigastrium, board-like abdominal rigidity with extreme tenderness, especially in the epigastrium, and a full unaccelerated pulse constitute a clinical syndrome not simulated by any other abdominal accident. When, however, the perforation is temporarily plugged by omentum or the leaking is arrested by a plastic adhesion of a nearby viscus, the characteristic picture may not be present. An aid to diagnosis in such doubtful or atypical cases is the demonstration roentgenologically of pneumoperitoneum.

Among the 47 cases in this series in which roentgenographic or fluoroscopic examination was performed, air was found under the diaphragm in 34, an incidence of 72 per cent.

Simple closure of the perforation is the treatment of choice. It was performed in 61 of the authors' series. Excision of the ulcer plus closure or pyloroplasty and simple closure plus gastro-enterostomy were done in some cases, but not in the last ten years. The operative mortality rate for the entire series was 8.7 per cent. There was an obvious relationship between the time of operation and the outcome. In 36 cases operated upon within six hours of perforation, there was no mortality, while 33 per cent of those in whom operation was delayed eighteen hours or longer died. Other factors believed to contribute to a low mortality rate are spinal anesthesia, the immediate (preoperative) use of intravenous therapy (plasma, glucose, saline), and gastric suction and administration of the sulfonamides postoperatively.

Of those surviving operation, 10 were not followed and 10 are known to have died. Only 3 patients are listed as cured, *i.e.*, as presenting no complaints relative to the stomach or duodenum at any time after the original operation for perforation. The average follow-up in these 3 cases was six years and a half. Thirty-eight patients had symptoms subsequent to operation requiring medical treatment or dietary restriction while 12 either had persistent symptoms unrelieved by conservative measures or underwent reoperation. Reperforation is known to have occurred in 8 patients, the majority of whom gave a history of (a) dietary indiscretions, (b) over-indulgence in alcohol or tobacco, (c) a high gastric acidity. V. A. LOOKANOFF, M.D.

**Symposium on Abdominal Surgery. Simple Penetrating Ulcer of the Cecum.** Curtice Rosser. Ann. Surg. **119:** 377–381, March 1944.

In reported series of non-specific ulcers of the colon, cecal lesions have far outnumbered those located elsewhere. They occur most frequently in males of middle age and present a clinical picture so lacking in characteristic features that an exact preoperative diagnosis is hardly to be expected.

In the acute form, with perforation or imminent perforation, the symptoms are indistinguishable from those of appendicitis and in a large percentage of cases operation has been undertaken under that misconception. According to various authorities, excision and suture of the ulcer or suture alone has been attended by successful results but reliance upon simple drainage has led invariably to a fatal outcome.

When the perforative process is slow, differentiation from carcinoma is difficult, as a mass is usually present as a result of the associated fibroplastic reaction, and there may be roentgen evidence of a constricting defect. Constipation is a common feature, with vague abdominal pain, low-grade fever, and slight tenderness. Rarely intestinal bleeding occurs.

Other conditions to be distinguished from simple ulcer are periappendicitis, cecal tuberculosis of the hypertrophic type, and regional ileitis extending to involve the colon. This last should be differentiated by the presence of diarrhea, its extreme chronicity, and its tendency to occur at an earlier age.

Two cases are presented, both diagnosed preoperatively as carcinoma of the colon. Both patients had pain in the right lower quadrant, with a mass in that area, and in each case a constrictive deformity of the cecum was demonstrable roentgenologically. The correct diagnosis was made by pathological study. In each instance the right colon was resected.

The author believes many unreported and unrecognized cases of simple ulcer have occurred. A good bibliography is furnished.

V. A. LOOKANOFF, M.D.

## THE PERITONEUM

**Roentgen Diagnosis of Fetal Meconium Peritonitis.** Edward B. D. Neuhauser. Am. J. Roentgenol. **51:** 421–425, April 1944.

Fetal meconium peritonitis frequently accompanies stenosis or atresia of the bowel. It has long been recognized that calcium deposition occurs within the collections of cornified epithelial cells extruded in the meconium, and it has been suggested that the calcification may begin as soon as twenty-four hours after the onset of the peritonitis. The author reports 3 cases in which it was possible to make a roentgen diagnosis of fetal meconium peritonitis by the demonstration of areas of calcification within the peritoneal cavity. In each instance atresia of the bowel was present, giving the usual picture of multiple dilated loops of intestine with air and fluid levels when the roentgenograms were made in the erect position. In addition, there were one or more irregular shadows of calcific density within the peritoneal cavity and either lying within the bowel lumen, within the bowel wall, or loosely adherent to the peritoneal surface of the bowel. The combination of these changes is believed to be characteristic of the condition described. L. W. PAUL, M.D.

## THE SKELETAL SYSTEM

**Intervertebral Disc Problem in the Navy.** F. Keith Bradford. U. S. Nav. M. Bull. **42:** 763–775, April 1944.

Though intervertebral disk rupture with root compression is an important source of disability among Navy personnel, proper selection of cases for operation, judicious surgery, and sagacious management will return many patients promptly to duty. The author is of the opinion that speedy recovery is the rule and that frank herniations will be found on adequate operative exposure, whether the diagnosis is based on clinical findings alone or clinical findings supplemented by contrast myelography. This is contrary to the experience of Dandy, whose cures took several weeks or months following operation for what he terms the "concealed disk" (J. A. M. A. **117:** 821, Sept. 6, 1941).

Lifting in a bent position and sudden twisting to regain balance are the types of trauma most often followed by herniation of the nucleus pulposus. A history of injury by violence is rare. Absence of a history of injury does not lessen the probability of a ruptured disk when other findings are characteristic. Back disability is usually the first symptom and persists through the period of sciatic pain, which is rarely bilateral and is usually of greater severity than the back pain. Exaggeration of pain by coughing and sneezing is a helpful finding, but its absence does not alter the conclusion if other observations are typical. Paresthesias of the skin of the foot or leg occurring spontaneously, after

exercise, in certain positions, or on coughing or sneezing, are important evidence when present.

The objective findings can be divided into back findings and radicular findings. Usually the patient assumes a protective posture, but pain in the back will occur on quick, unprotected motion. Forward bending is limited to 50 or 75 per cent of normal, while hyperextension is limited variably and lateral bending moderately. Not infrequently the patient may notice a localized area of paresthesia below the knee, taking the form of tingling, burning, electric shock, or a feeling of thickness of the skin. Compression of the fifth lumbar root by the fourth lumbar disk may produce either hypesthesia or paresthesia of the great toe and anterolateral leg. A paresis of the extensors of the great toe or the tibialis anterior may be noted when the muscles of the leg are tested under weight-bearing. Rarely the ankle jerk may be diminished. Herniation of the lumbosacral disk with pressure on the first sacral root may produce paresthesia or hypesthesia of the lateral foot and posterolateral leg. The ankle jerk is usually diminished or absent, while there may be a slight paresis of the Achilles muscle group.

Because of the increasing accuracy of clinical examination, contrast myelography is used much less frequently than formerly. In the group of patients with less conclusive findings, however, this procedure is required to prove or disprove a disk lesion. Pantopaque is favored as a contrast material because of its low viscosity, which facilitates examination of the entire spine and demonstration of small irregularities, and the ease of aspiration following completion of the procedure. Lipiodol is more difficult to aspirate and is usually less completely removed from the spinal canal. With air the entire spine is not examined, the contrast is poor, and small irregularities are not demonstrated. With thorotrast, severe after effects are occasionally noted and the procedure for drainage is complicated.

The puncture is made in the mid-line at the site of the suspected lesion, and the pantopaque (3 c.c.) is slowly injected after a free flow of cerebrospinal fluid is obtained. The stylet is then replaced, and the patient is examined fluoroscopically on the tilt table in the prone position. Numerous spot films are made with the pantopaque balanced opposite each of the lower two intervertebral disks and with the sacral sac completely filled by having the patient stand upright. After fluoroscopy is completed and the spot-films checked for satisfactory exposure, the pantopaque may be aspirated by bringing the table to such an angle that the point of the needle is in the center of the column. Aspiration will either be possible with a minimal force, or completely impossible.

Partial hemilaminectomy is regarded as the routine treatment. Operation in the sitting position is preferred, as flexion of the lumbar spine and weight-bearing bring out the herniated cartilage more prominently.

The satisfactory results obtained have been adequate repayment for the pains taken in accurate diagnosis.

ELLWOOD W. GODFREY, M.D.

**Acute Suppurative Arthritis of the Hip in Childhood.** Peter E. Russo. Am. J. Roentgenol. **51:** 447–454, April 1944.

Acute suppurative arthritis of the hip in childhood is discussed from the standpoint of (1) anatomical factors, (2) types of arthritis, (3) bacterial characteristics, and (4) roentgenologic aspects. This is a relatively frequent disease of childhood and early adolescence. In the author's series of 40 cases in children under fifteen there were 22 males and 18 females; 27 of the patients were from ten to fourteen years old.

In the primary type of acute suppurative arthritis, the infection attacks the synovial or perisynovial structures. In the secondary type the location is primarily intraosseous and the joint is affected by spread or extension of the bone infection. The primary type is in most instances of streptococcal origin and usually subsides within five weeks. The affected hip in many cases regains its normal range of motion. The secondary type is usually due to staphylococcal infection and tends to run a long drawn out course. Draining sinuses may take months or years to heal. Range of motion is in most cases seriously impaired, and ankylosis and deformities of the hip result in the majority of cases.

Roentgenograms are invaluable in detecting the presence of arthritic lesions of the hip, in following the different phases, and in evaluating the end-result. The early stages are manifested by narrowing of the joint space, which occurs as early as five days after onset of the disease. Another early roentgen finding, described by Chont (Radiology **38:** 708, 1942), consists in a lateral and upward subluxation of the femoral head. This differs from the findings encountered in congenital dislocation by the associated soft-tissue swelling of the pelvic girdle and the ground-glass appearance of the bone, which is usually of normal and uniform density in the congenital cases. In early hip infection, the epiphyses of the femoral heads are equally well developed but differ in density. When the disease is primarily intraosseous, the bone lesions may not be identified on the roentgen film for ten or fifteen days after the onset. Evidences of osteomyelitis then make their appearance.

The primary type of arthritis occurs mostly in children under two years of age. The secondary type is much more common, the most frequent sites of the intraosseous lesion being the femoral neck, the ilium, the ischium, and pubis, in the order mentioned.

L. W. PAUL, M.D.

## THE GENITO-URINARY TRACT

**Incidental Findings in Urograms Concerning the Uterus.** J. T. Marr and U. V. Portmann. Am. J. Roentgenol. **51:** 426–433, April 1944.

The shadow of the dye-filled urinary bladder often varies in shape in men and women. In the former the upper surface usually is convex, while in females it frequently is concave. This observation suggested that the concave impression was due to the uterus. To confirm this hypothesis 50 urograms of men were studied to determine the usual shape of their bladders. The majority were convex across the fundus but a few were flattened or slightly irregular. Five hundred unselected urograms of women were then examined to study the impression of the uterus on the bladder, and the findings were correlated with case histories and pelvic examinations.

It was found that the size, shape, and position of the uterus and the presence of pathological conditions in the pelvis could often be determined by the contour of the impression on the bladder seen in the urogram. Absence of a uterine impression on the bladder may be explained on the basis of (*a*) too small a uterus, (*b*)

retroflexion or retroversion of the uterus, (*c*) absence of the uterus, as a result of hysterectomy, (*d*) atrophy of the uterus after a natural or induced menopause, (*e*) overdistention of the bladder with opaque medium. When the concave impression on the bladder is visible, its width is a good indication of the width of the uterine fundus. Occasionally, the fundus can be seen even in plain roentgenograms as a soft-tissue shadow. All patients had urograms made at five-, fifteen-, thirty-, and sixty-minute intervals, the last giving the most information because the bladder usually contained more opaque medium and uterine impressions were deeper. It is probable that urograms made in the upright position would give more accurate information since the uterus would fall more heavily upon the bladder. In certain cases cystograms may be indicated for the specific purpose of studying uterine impression and roentgenoscopy while the bladder is filling might be of value.

The information obtained concerning the size and shape of the uterus may be of clinical importance, since manual pelvic examinations, even by physicians with experience, do not always agree as to uterine size, and in some patients it is difficult to do pelvic examinations and obtain even a rough estimate of the size or position of the uterus. L. W. PAUL, M.D.

## RADIOTHERAPY

### MALIGNANT NEOPLASMS

**Treatment of Cancer of the Larynx by Roentgen Irradiation: Report of Five Year End-Results.** John V. Blady and W. Edward Chamberlain. Am. J. Roentgenol. **51:** 481–495, April 1944.

In an analysis and five-year-survival study of 36 cases of cancer of the larynx treated during the years 1931 to 1937 in the Department of Roentgenology and Radium Therapy of Temple University Hospital (Philadelphia), 23 (64 per cent) were classed as intrinsic and 13 (36 per cent) as extrinsic. Metastases were infrequent in cancer of the intrinsic larynx; only 4 of the 23 patients presented metastases on admission, while in 2 metastases developed later in the course of the disease. In the extrinsic group, metastasis is more common; 6 of the 13 patients showed metastatic lesions at the time of admission. None of the patients having proved cervical metastases on admission survived. For the 17 patients with intrinsic cancer without metastasis at any time during the course of the disease, the five-year survival rate was 71 per cent. In the comparable group of extrinsic cases, numbering 7, there were 3 five-year survivals (43 per cent).

The daily dose of radiation was 125 r, measured in air, delivered through 10 × 10-cm. fields to each side of the neck at a rate of 5 to 6 r per minute. A total of at least 3,000 r was delivered to each skin field, requiring a minimum of twenty-four consecutive days for the completion of treatment. The physical factors were 180 kv. constant potential, 5 ma., 50 cm. target-skin distance, and 2 mm. copper plus 1 mm. aluminum filtration. It was found that the upright position was more comfortable for the patient and allowed more accurate centering, and after 1935 this position was used, the head being supported by a head rest fastened to the back of an ordinary chair. Also during the latter part of the period, the use of large rectangular fields was discontinued and interchangeable circular metal cones, varying in diameter from 5.5 to 10 cm., were employed. With these smaller fields the cutaneous reaction may be as severe as with the large fields, but the area and volume of tissue involved are much less; thus, larger tumor doses may be administered without producing severe local and generalized constitutional reactions. Because the use of small cones requires accurate localization of the radiation beam, the anatomic location of the lesion should be carefully centered on the skin of the neck after thorough localization of the lesion by direct vision or palpation. The accuracy of the centering may be checked by exposing a roentgenogram, using the therapy machine for this purpose.

The various reactions and complications of treatment encountered in this series are discussed in some detail. Methods for relieving the discomfort accompanying the unavoidable skin and mucous membrane reaction are described. L. W. PAUL, M.D.

**Roentgen Rays in the Treatment of Carcinoma of the Bronchus, with an Analysis of 69 Cases Treated in the State of Wisconsin General Hospital from 1933 to 1943.** Ernst A. Pohle and Evelyn L. Siris. J. Thoracic Surg. **13:** 67–83, April 1944.

Sixty-nine cases of carcinoma of the lung treated by roentgen rays are reviewed. Of these, 42 were far advanced, with metastases before the diagnosis was made. For the more favorable cases the treatment factors were as follows: 400 kv.; 5 ma.; 50 cm. distance; half-value layer in Cu, 2.4 mm.; 200 r daily to each of two portals, 10 × 10 cm. to 15 × 15 cm., anteriorly and posteriorly; total dose in air 2,400 to 3,000 r to each portal, or in the average 21-cm. chest a tumor dose of 2,500 r, which the authors indicate is a carcinocidal dose. Six weeks or so later a second series of 1,500–2,000 r in air is given to each of two portals anteriorly and posteriorly. Further treatment is then given in small amounts, not less than three months apart. The authors advise against large fields and against treating infected areas. In advanced cases, in debilitated patients, 800–1,600 r is given to each of two portals to alleviate symptoms. In cases with widespread metastases 1,200–1,600 r in air is given to two opposing fields for relief of pain.

One patient survived six and one-half years after diagnosis; only 5 lived over two years. The authors conclude that the greatest value of radiation therapy in patients with carcinoma of the bronchus lies in its palliative effect. Only occasionally can a five-year survival be achieved. HAROLD O. PETERSON, M.D.

### TECHNIC, DOSAGE, APPARATUS

**Use of Wedge Filters in Deep X-Ray Therapy.** F. Ellis and H. Miller. Brit. J. Radiol. **17:** 90–94, March 1944.

For the treatment of tumors near the surface, such as one side of the floor of the mouth, the ethmoid region, the middle ear, the vulva, the anus, and the brain, the use of wedge-shaped filters is advocated. Wood or brass is used in the filter. The field produced has an asymmetrical distribution of radiation. Depending on the location the wedge-filtered fields are

used at right angles to each other or directly opposite. They may sometimes be advantageously combined with a conventionally filtered field. One particular advantage is that whatever the combination the depth dose falls off rapidly at the edge of the field. Typical depth distribution curves are given.

SYDNEY J. HAWLEY, M.D.

**A Dosage System for Linear Gamma-Ray Sources.** D. E. A. Jones. Brit. J. Radiol. **17:** 46–47, February 1944.

For treating lesions like carcinoma of the rectum, uterus, etc., where the area treated approximates a cylindrical surface, an approximately uniform dose may be obtained by axially placed spaced radium. Graphs are presented for determining the amount of spacing of the radium source for various sizes of cylinders.

SYDNEY J. HAWLEY, M.D.

**Time Intensity Factor in X-Ray Irradiation. Pt. I. The Influence of the Overall Time.** Edith Paterson. Brit. J. Radiol. **17:** 26–30, January 1944.

Experiments *in vitro* on fibroblasts of the chick embryo, varying the over-all time but keeping the total dose constant, show that there is no significant difference in the radiation effect in short over-all times. Increasing the over-all time to four days decreases the survival rate of the fibroblasts, but there is no significant difference produced by various spacings of the sessions. Increasing the over-all time to twenty-one days, with eleven sessions, was found to produce the greatest effect.

These experiments indicate that prolonging the over-all time with suitable splitting offers advantages over short-time irradiation. The survival times are more homogeneous and the lethal effect is enhanced.

SYDNEY J. HAWLEY, M.D.

## EXPERIMENTAL STUDIES

**Retention of Radioactive Phosphorus when Administered in Different Chemical Forms.** Shields Warren and Russell F. Cowing. Cancer Research **4:** 113–115, February 1944.

The efficacy of radioactive phosphorus as a therapeutic agent in some types of leukemia and allied diseases has been demonstrated. The form in which radioactive phosphorus has thus far been administered is the dibasic sodium phosphate ($Na_2HP'O_4$). Since this is not readily prepared chemically, since the half life of radioactive phosphorus is limited (14.3 days), and since the services of skilled chemists are difficult to obtain at the present time, it has become of practical importance to determine whether or not more easily prepared forms containing the phosphate acid radical are satisfactory for therapeutic use. Radioactive phosphorus in the form of magnesium ammonium phosphate and of phosphoric acid was used for this study. No reactions were encountered with the intravenous administration of these two compounds.

The amounts of radioactive phosphorus administered ranged from 130 to 3,850 $\mu$c. in the case of $Na_2HP'O_4$, from 1,100 to 3,900 $\mu$c. in the case of $MgNH_4P'O_4$, and from 1,000 to 4,000 $\mu$c. in the case of $H_3P'O_4$. All measurements represent microcurie equivalents and were made with a modified Geiger counter checked against the Lauritsen type electroscope as modified by Hudson and Cowing.

The retention of the radioactive phosphorus was practically identical regardless of which of the three compounds was used. In the case of dibasic sodium phosphate and in the case of phosphoric acid, one instance each of poor retention was encountered, in the former unexplained and in the latter due to extensive intestinal hemorrhage. The therapeutic effect of these three compounds in the treatment of leukemia has been indistinguishable.

If it is necessary to conserve time in the preparation of radioactive phosphorus for therapeutic use, $H_3P'O_4$ or $MgNH_4P'O_4$ may be substituted for $Na_2HP'O_4$ as the vehicle of administration.

**Comparative Studies on the Radiosensitivity of Normal and Malignant Cells in Culture. II. The Delayed Lethal Effect.** L. Doljanski, G. Goldhaber, and L. Halberstaedter. **III. Further Studies on the Inhibitory Effect of X-Rays on Cell Outgrowth.** G. Goldhaber, L. Doljanski, and L. Halberstaedter. Cancer Research **4:** 106–109, 110–112, February 1944.

In a previous communication (Cancer Research 2: 28, 1942. Abst. in Radiology **39:** 252, 1942) the authors showed that the "immediate lethal dose" of x-rays for rat sarcoma cells *in vitro* is the same as that for normal rat fibroblasts. Doses of 200,000 r uniformly and immediately check all cell outwandering in cultures of normal as well as neoplastic cells. Further studies on radiosensitivity of normal and malignant cells showed that a dose of 2,000 r rendered prolonged cultivation of the irradiated cultures uniformly impossible, while the effect of smaller doses was inconstant. On this basis the minimal delayed lethal dose of x-rays for rat sarcoma cells cultivated *in vitro* is given as 2,000 r. This is less than half the equivalent dose for normal chick fibroblasts, whose proliferative capacity is irreversibly checked only after irradiation with 5,000 r. The minimum dose of x-rays that causes appreciable inhibition of growth rate in a sarcoma cell culture was found to be 500 r. The corresponding dose for normal chicken fibroblasts is 2,500 r.